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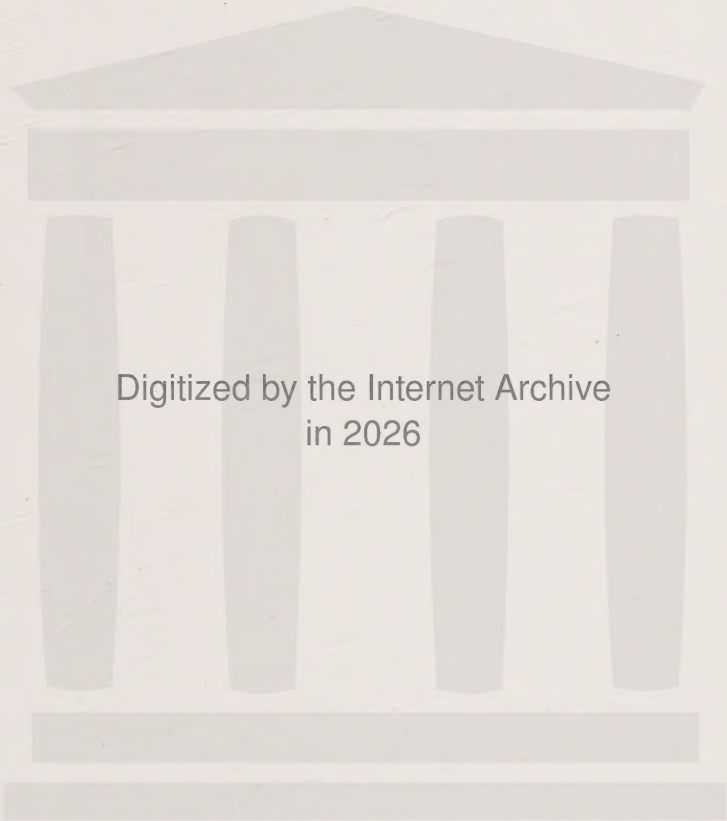

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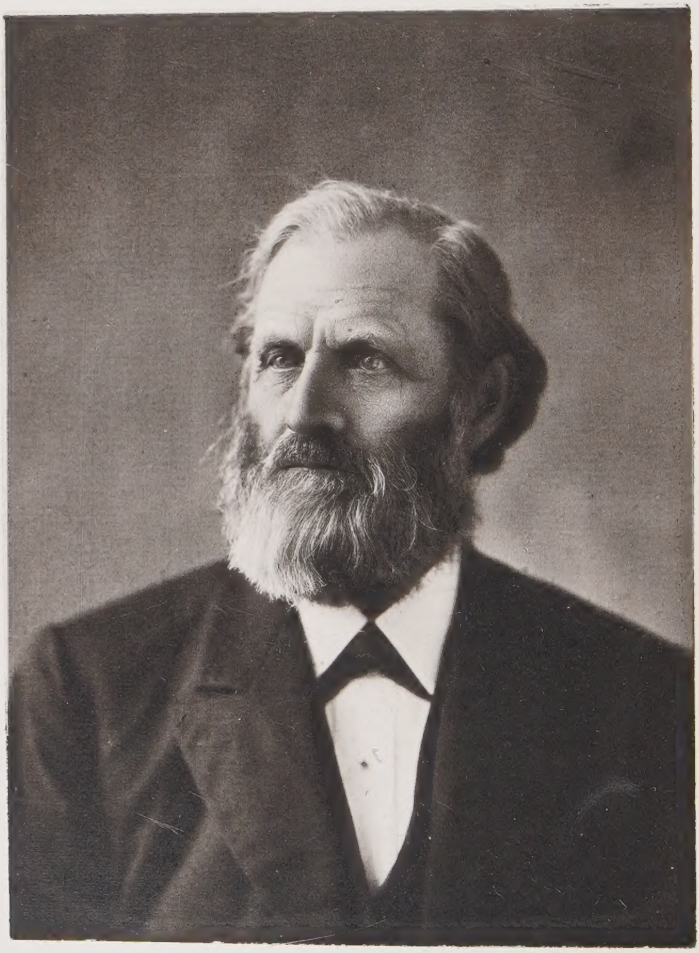

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D. S. Sheldon.

PROCEEDINGS

OF THE

DAVENPORT ACADEMY

OF

NATURAL SCIENCES.

VOLUME V.

1885—1889.

DAVENPORT, IOWA:
PUBLISHED BY THE ACADEMY OF NATURAL SCIENCES.
1893.

PUBLICATION COMMITTEE—1893.

MRS. M. L. D. PUTNAM, *Chairman.*

REV. W. H. BARRIS. DR. C. H. PRESTON.

PROF. SAMUEL CALVIN. DR. JENNIE McCOWEN.

The authors of the various papers are alone responsible for what is contained in them. The date of the printing of each sheet is printed in each signature line.

EDWARD BORCHERDT, PRINTER.

PREFACE.

THE Fifth Volume of the Proceedings of the Davenport Academy of Natural Sciences is submitted to the scientific public with the hope that it may be found on the same plane of worth and interest with the volumes heretofore issued.

Valuable work in various fields is shown. Of special interest are the five botanical papers of the late Dr. C. C. Parry, and to him also fell the kindly task of preparing the memorials, herein contained, of the late Prof. D. S. Sheldon, LL. D., first President of the Academy, and of the late R. Smetham. The last work of Dr. Parry's life was the paper on "Ceanothus, L." Only those most intimately connected with the publication of the Proceedings of the Davenport Academy of Natural Sciences can appreciate how much of success was due to the fertile brain, untiring energy, and well-earned, world-wide reputation of Dr. Parry. Many an early morning hour found him, after a brisk walk from his country home, in consultation with the Chairman. The last pages of Volume V., fresh from the press, were brought by him to the train, September 22, 1889, as the Chairman started on a journey across the seas. The farewell words were spoken, the last grasp of the hand taken, for in a brief time—February 22, 1890—Dr. Parry took the longer journey from whence no traveler returns. The publication since then has taken a long rest, ostensibly waiting for the "Index"—really paralyzed by the repeated inroads upon the membership made by death and removals.

Among the prominent supporters of the Academy who have been called away was the late Charles E. Putnam, who contributed so much to the permanent value of its publications, and whose efficient administration as President closes this Volume. The late James Thompson, whose sudden death occurred a few hours after his reëlection to the Presidency, was a member of the Publication Committee. The removal of our former enthusiastic Curator, Prof. W. H. Pratt, to Minneapolis, is felt as a very serious loss.

Other willing and able hands are taking up the work in various lines, and continued generous support by the community at large, and accumulating bequests to the Endowment Fund, give every reason for encouragement in the future. Prof. Samuel Calvin, Iowa State Geologist, and Dr. Jennie McCowen are now on the Publication Committee. Prof. W. H. Barris, whose reputation as a geologist needs no mention, has taken the place of Prof. Pratt, as Curator.

On December 14, 1892, the twenty-fifth anniversary of the founding of the Academy was celebrated by a successful entertainment, one delightful feature of which was the reading by the Secretary, Dr. Jennie McCowen, of a most carefully-prepared paper, giving a concise résumé of the history and work of

the Academy. Many letters of congratulation from distant friends were read. The marked increase of the library since the distribution of the Proceedings is very gratifying. It now contains over 28,000 volumes, which are housed in the fire-proof building of the Academy.

The Synopsis of Proceedings — in which will be found, page 248, a revision of the Constitution and By-Laws, as adopted March 25, 1887 — is brought down in this volume from 1885 to 1888, inclusive. A completed index of the five volumes thus far published is appended, for the preparation of which the Academy is indebted to Prof. W. J. McGee, of the United States Geological Survey, and his able assistant, Mr. Van Doren. The portrait of the late Prof. D. S. Sheldon, LL. D., as frontispiece of Volume V., was the gift of his former pupils of Griswold College, through the efforts of Mr. George F. Henry, of Des Moines.

It is the purpose of the Academy to publish hereafter in brochure form all papers accepted, as soon as possible after presentation. In pursuance of this plan, the following have already been issued as part of Volume VI.:

1. Bibliography of Iowa Antiquities, by Frederick Starr, Ph. D., of Chicago University.
2. Ancient Grooved Rocks in Arkansas, by W. A. Chapman.
3. Buddhism in America, by Edward L. Berthoud, of Golden, Colorado.

Among other papers promised are one by Prof. Calvin, of the State University, and one by Prof. Barris on the local geology of Davenport.

The portraits of Dr. C. C. Parry and C. E. Putnam will also be contained in Volume VI., with biographical sketches.

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PROCEEDINGS

OF THE

DAVENPORT ACADEMY

OF

NATURAL SCIENCES.

VOLUME V.

PAPERS.

ON CERTAIN RECENT, QUATERNARY, AND NEW FRESH-WATER MOLLUSCA.

BY R. ELLSWORTH CALL.

Read before the Academy, February 26th, 1886.

THE area which has contributed most of these forms is little known conchologically. All the knowledge gathered concerning its molluscan fauna is fragmentary, and, for the most part, scattered through many publications, rendering a collation of their information an imperative need. Such a collation has been for some time in progress, and the present writer hopes soon to present a summary of the results.

Of the six species herein described, four have hitherto been characterized by me, two of which were, in deference to authority, given only varietal rank. It is now proposed to recognize the varietal names as of specific value, and to republish the original descriptions as applicable to the specific name. This disposition is made in the light of continued and careful study of these forms in conjunction with well-preserved specimens of the species of which they were formerly regarded as varieties.

RISSOIDÆ.

Genus AMNICOLA Gould & Haldeman (1841).

Amnicola dalli, sp. nov.

(Plate I., Figs. 4–6.)

Amnicola dalli, Call.—Bull. U. S. Geol. Sur., No. 11, p. 45, Plate VI., Figs. 4–6 (1884).

Shell narrowly umbilicate, obtusely conical, shining, slightly striated, brown or greenish horn color; whorls four, convex, gradually increasing in size; suture regularly impressed, somewhat deep; aperture rounded before, somewhat angular behind, bluish white within; lip simple, sharp, margins joined by a thick callus, columella rather reflexed.

Length, 3.50^{mm}; breadth, 2.30^{mm}.

Habitat and Station.—Mountain streams tributary to Pyramid Lake, North-west Nevada.

For the diagnosis of the lingual dentition I am indebted to Mr. Charles E. Beecher, who has prepared the following description and illustrations:

"Jaw thin, membranaceous.

"Odontophore 1.10^{mm} long, .13^{mm} wide. In a full-grown example the odontophore has 94 transverse rows of teeth, with the formula $3-1-3$.

"Rhachidian tooth short and broad, with the inferior lateral angles produced. Cusp with seven denticles, of which the central one is the largest. The anterior lateral faces are each furnished with a short, strong, conical denticle, and the adjacent lateral margin of the tooth is thickened and slightly produced. Formula for rhachidian tooth:

$$\frac{3+1+3}{1+1}$$

"Body of intermediate tooth quadrate; infero-interior angle somewhat produced; furnished with a large bullation, into which the infero-interior angle of the succeeding tooth appears to fit as if for articulation. Peduncle long and straight. Cusp with seven strong angular denticles, arranged according to the formula $2+1+4$.

"Body of the first lateral tooth elongate-triangular, oblique to the direction of the broad peduncle. Cusp inflected, and carrying twenty-three slender denticles.

"Outer lateral tooth hamate, with no marked distinction between the body and peduncle. Free extremity incurved and bearing thirty-four minute denticles. The denticle formula is, therefore,

$$34-23-7-\frac{3+1+3}{1+1}-7-23-34.$$

"The apparent articulation of the intermediate teeth, as described above, was observed in a fragment of an odontophore which presented a lateral aspect under the microscope. It is not known that this feature has ever been noted in any other species, although it very probably occurs in many which have foraminated or bullate teeth. This disposition of the teeth would allow great flexion of the odontophore without their displacement."

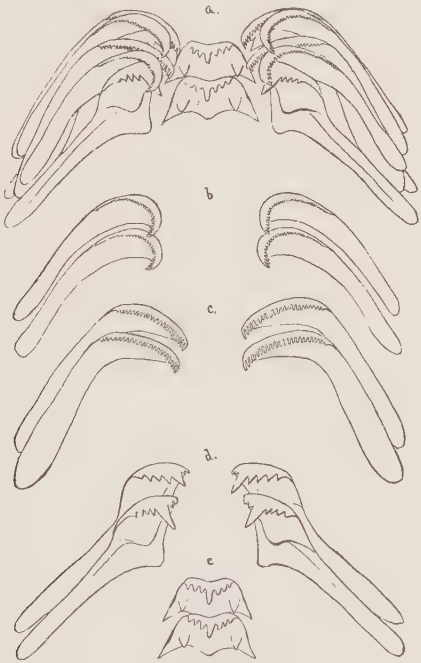


FIG. 1.— Lingual dentition of *Amnicola dalli*, Call × 400.— Beecher.

a.—Two of the transverse rows of the odontophore, showing the normal position of the teeth. The teeth are considered as opaque.

Analysis: *b.*— Outer laterals. *c.*— First laterals. *d.*— Intermediate teeth. *e.*— Rachidian teeth.

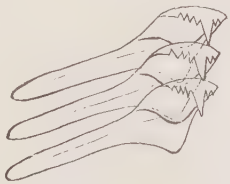


FIG. 2.— Intermediate teeth (× 400), showing mode of articulation.— Beecher.

This quite distinct form was collected in considerable numbers at Symon's Stage Station, near the foot of Pyramid Lake, Nevada. Its nearest congener is *A. porata* Say, from which it differs in elevation, sculpturing, and dentition. Since this last character is the one of chief importance, the description of the dentition is here given. Comparing the denticle formulæ of the two forms, thus:

A. porata.

$$30-18-5-\frac{3+1+3}{4+4}-5-18-30,*$$

A. dalli.

$$34-23-7-\frac{3+1+3}{1+1}-7-23-34,$$

the dissimilarity is strongly marked. Specimens may be seen in numerous private collections, and in the cabinets of the Smithsonian Institution, the New York State Museum of Natural History, and the Davenport Academy of Natural Sciences.

VALVATIDÆ.

Genus VALVATA Müller (1774).

Valvata utahensis, sp. nov.

(Plate I., Figs. 1–3.)

Valvata sincera, var. *utahensis*, Call.— Bull. U. S. Geol. Sur., No. 11, p. 44, Plate VI., Figs. 1–3 (1884).

Shell operculate, narrowly umbilicate, conical, with minute transverse striæ, shining, somewhat pellucid, yellowish horn color at apex, white below; spire obtusely elevated, flattened at tip; suture well impressed; whorls four, convex, regularly increasing, the uppermost ones with a single well-marked carina, which becomes obsolete on the last whorl; last whorl equals one-half the whole length of the shell; aperture circular, slightly angled posteriorly; peristome simple, continuous, joined to the next whorl above by a very slight calcareous deposit; within white.

Operculum light horn color, corneus, spirally multivolute, slightly produced posteriorly to conform to the shape of the aperture. Dentition unpublished.

Length, 4.80^{mm}; breadth, 3.20^{mm}.

Habitat.— Lake Utah, Utah.

* After Stimpson, Smithsonian Misc. Coll., No. 201, p. 14, Fig. 6; also *ibid.*, No. 144, p. 80, Fig. 158.

This form was dredged by the writer, in August, 1883, in great numbers in Utah Lake, near Lehi, not far from the head of the River Jordan. It is intermediate between *Valvata sincera* Say and *V. virens* Tryon. From the first it differs in the unicarinate upper whorls, in being more elevated, in possessing a very much smaller umbilicus, and in its greater size. From the second it differs in color, size, carination, and form of aperture. It resembles, in some respects, *V. unicarinata* De Kay (= *V. tricarinata* Say), but differs in size, ornamentation, and form of aperture. Specimens may be seen in the Smithsonian Institution, in the New York State Museum of Natural History, in the Davenport Academy of Natural Sciences, and in the private collections of Beecher, Stearns, Dall, Aldrich, and the writer.

LIMNÆIDÆ.

Genus RADIX Montfort (1810).

Radix utahensis, sp. nov.

(Plate I., Figs. 7–9.)

Radix ampla, var. *utahensis*, Call. — Bull. U. S. Geol. Sur., No. 11, p. 47, Plate VI., Figs. 7–9 (1884).

Shell globose, somewhat umbilicated, irregularly costate, light horn color, nearly pellucid; spire rather small, conical; whorls four to four and one-half, convex, somewhat flattened above, giving rather a shouldered appearance to the whorls, rapidly increasing in size, the last whorl being inflated, with numerous rather marked transverse costæ, minutely wrinkled; suture somewhat deep, regularly impressed; aperture elongately ovate, effuse, approaching patulous, pearly white within; outer lip simple, the margin connected by a slight calcareous deposit; columella somewhat twisted, but straight in front. Dentition unpublished. Length of largest specimen, 16.82^{mm}; breadth, 8.88^{mm}. The average of nine specimens gave a length of 13 40^{mm}, breadth 7.10^{mm}, with about the same ratio for corresponding measurements of aperture.

Length, 13.40^{mm}; breadth, 7.10^{mm}.

Length of aperture, 9.00^{mm}; breadth of aperture, 5.90^{mm}.

Habitat and Station.— Lake Utah, Lehi, Utah.

This is a rare form in Utah Lake, its only locality so far as known. Its nearest affinity is *Radix ampla* Mighels. In the preceding reference its relation to *Polyrhytis kingii* Meek has been noted. It was associated with abundant specimens of the *Valvata* herein described, and with *Fluminicola fusca* Haldeman and *Sphærium dentatum* Haldeman. Specimens may be seen as above.

Genus LIMNOPHYSA Fitzinger (1833).

Limnophysa bonnevillensis, sp. nov.

(Plate I., Figs. 10–13.)

Limnophysa bonnevillensis, Call.—Bull. U. S. Geol. Sur., No. 11, p. 48, Plate VI., Figs. 10–13 (1884).

Shell umbilicated, elongate, ventricose or bullate, somewhat solid, faintly striate and very minutely reticulated below the suture, the last whorl bearing faint longitudinal ridges or costæ; spire elevated, acute; suture deeply impressed; whorls 4 to 4½, very much rounded, sometimes tending to geniculation above, the last whorl equal to three-fourths the whole length of the shell, rapidly increasing in size, much swollen, somewhat expanded at base; columella somewhat plicate, slightly callous, regularly arcuate; columella and peristome continuous; peristome simple, margins joined by a heavy callus, which is continuous and so reflexed as to partially close the umbilicus; aperture broadly ovate, often patulous, equal to one-half the entire length of the shell, oblique, angled slightly behind.

Fossil, Quaternary. Bonneville Lake beds, Kelton, Utah.

The four largest specimens of the many in the collections give the following dimensions:

SPECIMEN.	LENGTH.	BREADTH.
	mm.	mm.
1	15.00	7.80
2	11.00	5.80
3	9.40	5.20
4	18.50	6.00

STREPOMATIDÆ.

Genus GONIOBASIS Lea (1862).

Goniobasis stearnsiana, sp. nov.

FIG. 3.
GON. STEARNSIANA. $\times \frac{3}{2}$

Shell globose, not very elongate, excavated in umbilical region, but not umbilicated, usually coarsely and obliquely costate on upper whorls; spire conical, not much elevated; whorls 5½–6½, scarcely convex, appressed at the suture, body-whorl very large, more than equalling one-half the entire length, often angulate at periph-

ery, above which it is flattened, many-banded and smooth, or bandless and coarsely multistriate, the striæ cord-like and variable in number, coarsely and obliquely wrinkled by the well-marked lines of growth; suture well but irregularly impressed; aperture oblique, trapezoidal, twice as long as broad, effuse, white or creamy-white within, often banded with broad purple bands, slightly retuse at columellar region; peristome simple, sigmoid, a little thickened, somewhat reflexed at base of columella; columella thickened, always white, twisted; parietal wall usually with a thick deposit of callus, which is sensibly thickened near the posterior angle of aperture.

Operculum black, otherwise as usual in the genus.

Habitat and Station.—This shell occurred only in a limited area in Dyke's Creek, a clear and cold mountain stream tributary to the Etowah River, Floyd County, Georgia. Associated with it were numerous specimens of *Margaritana georgiana* Lea, two species of undetermined *Unio*, *Goniobasis vittata* Anthony, and *Goniobasis bella* Conrad. It has the habit of *Anculosa*, and is to be sought only in the most swiftly flowing and deepest portions of the stream, on rocks. It is not abundant, the most painstaking examination revealing some two hundred individuals.

The characters given are those which appear to be most constant, though some of these are variable. The variations, as usual in this family, range through wide limits. Thus, occasional specimens of the smooth and banded type depart so far from the figure that the whorls are loosely coiled and very much rounded; this does not appear to be of varietal value, but is pathologic. The color, again, ranges from light yellow to dark olive, and the peripheral angle becomes almost a carina. The average dimensions of seventeen individuals are, for length, 21.14^{mm}; for breadth, 12.02^{mm}. The largest specimen has a length of 26.08^{mm} and a diameter of 14.00^{mm}.

Specimens may be seen in the United States National Museum, Cornell University, New York State Museum of Natural History, Amherst College, Davenport Academy of Natural Sciences, and in the private collections of C. E. Beecher, T. H. Aldrich, and the writer. The species is named in honor of Dr. R. E. C. Stearns, so well known for his researches on the Pacific Coast mollusca.

CORBICULIDÆ.

Genus SPHÆRIUM Scopoli (1777).

Sphærium uintaense, sp. nov.

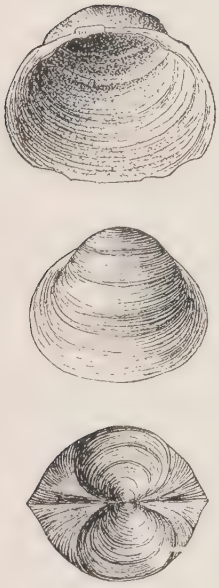


FIG. 4.
SPHÆRIUM UINTAENSE.
× 5

Shell thin, small, globose, ventricose, slightly inequilateral, posterior and anterior margins well rounded, very slightly produced posteriorly; umbones large, subcalyculate, full, rounded, dark, retaining embryonic shell, approximate; basal margin rounded, thus giving a circular outline to shell; epidermis shining, dark straw or olive colored, substriate, light yellowish on basal margin; cardinal teeth microscopic, slightly in advance of the middle region of the umbones, not widely separating; lateral teeth small, short, somewhat upcurved.

Viewed in profile from in front, the point of junction of lower portion of valves with the embryonic shell appears as a well-marked obtuse angle.

Length, 4.76^{mm}; diameter, 4.02^{mm}; number of specimens, eight.

Habitat and Station.— A lake in the Uinta Mountains, Utah, at an elevation of 10,500 feet. The specimens were communicated by Prof. Orson Howard, of Salt Lake City, and were collected by him in August, 1885.

This species is remarkable for its small size, all the specimens seen being mature, and one with fry, and for the great elevation at which it occurred. This is by far the greatest hypsometic range recorded for any lamellibranch. The lake is snow-fed, and therefore its normal temperature must be far below that of waters in which the *Corbiculidæ* usually occur. Its extreme fragility and small size, it is believed, must be coördinated with these features of its environment. Specimens are in the collection of Prof. O. Howard and of the writer.

It may not be altogether improper, in this connection, to advert to the lax usage of naturalists in connection with the terms *habitat* and *station*. They are used as though strictly synonymic, while possessed of a definite and precise meaning. It is proposed, therefore, that the term *habitat* be used in the sense of geographic distribution, while *station* should be used always and alone to indicate the immediate physical environment of the form considered. Such is the sense herein contemplated.

ON PYRGULOPSIS, A NEW GENUS OF RISSOID MOLLUSK, WITH DESCRIPTIONS OF TWO NEW FORMS.

BY R. ELLSWORTH CALL AND HARRY A. PILSBRY.

Read before the Academy, February 26th, 1886.

In September, 1883, Mr. R. E. C. Stearns described a rissoid mollusk from Pyramid Lake, Nevada, under the name of *Pyrgula nevadensis*. His description was based, in part, upon material furnished by one of the present writers, which was, at that time, inconsiderable in amount. In the following year the form was collected in almost incredible numbers in the original locality, and studied by Messrs. Call and Beecher in as complete a manner as rather unfavorable circumstances would admit. At that time the generic reference of the species appeared to be unquestionable, and, in the absence of specimens of European *Pyrgula* for comparison, was agreed upon as probably correct. Since this later study of the Nevada form, in which the dentition was illustrated and found to be rissoid, additional data have accumulated, which appear to render impossible the original generic reference. These data consist, in the main, of a careful study of the original bibliographic matter concerning the institution of *Pyrgula* as a genus, of the discovery of at least two additional forms which seem to be congeneric with *Pyrgula nevadensis*, neither of which agree with typical *Pyrgula*, either in station or understood hypsometric range, and of certain conchologic features that appear in the following diagnosis. In the further absence of any generic group which will include these shells, it has seemed proper to institute for their reception a genus that would do no violence to their conchologic affinities or to their geographic distribution. We therefore propose the name of *Pyrgulopsis* for these forms, and define the genus as follows:

PYRGULOPSIS, *gen. nov.*

(Etymology: *Pyrgula*, and *opsis* aspect of.)

Type, *Pyrgulopsis nevadensis* Stearns.

Pyrgula nevadensis Stearns.— Proc. Phila. Acad. Nat. Sci., 1883.

Generic characters: Shell minute, conically turreted, somewhat elongated, imperforate, unicarinate; apex acute; aperture ovate; peritreme continuous.

Operculum ovate, thin, corneous, spiral, with polar point well forward and approximating the columella.

Jaw thin, membranaceous.

Odontophore with teeth arranged in transverse rows, according to the formula $3+1+3$. Formula for denticles of rhachidian:

$$\frac{4+1+4}{1+1.}$$

Distribution: Western and South-western United States, in fresh or brackish water.

So far as known to us, the typical European *Pyrgulæ* are bicarinate or multicarinate. The type of the genus is the species described by Michelin* as *Melania helvetica*. The founders of the genus, Christoforo and Jan, described the same form as *Pyrgula annulata*, from a locality in Switzerland. Figures 11 and 12 of Plate II. are drawn from Switzerland specimens of this form.

As above defined, this genus will include the form described by Mr. John Wolf as *Pyrgula scalariformis*.† Although the first described species, it was not considered advisable to constitute this form the type of the genus. Being a post-pliocene fossil, it was impossible to indicate those characters in the animal itself which are desirable in framing an intelligible diagnosis. These have, so far as the operculum and dentition go, been studied in the Nevada form only. The remaining species to be included are, besides the type, *P. mississippiensis*, sp. nov., and *P. spinosus*, sp. nov.

DESCRIPTIONS OF THE SPECIES OF PYRGULOPSIS.

Pyrgulopsis nevadensis Stearns.

(Plate II., Figs. 1–10.)

Pyrgula nevadensis Stearns. — Proc. Phila. Acad. Nat. Sci., p. 173, figure (1883). —Call and Beecher, Am. Nat., Sept. 1884, Vol. XVIII., pp. 851–855; from this paper the present account of the dentition is copied.—Call, Bull. U. S. Geol. Survey, No. 11, 1884.

Shell small, somewhat elongated, variable, turreted, imperforate; whorls $4\frac{1}{2}-5\frac{1}{2}$, strongly unicarinate on periphery, otherwise smooth; epidermis shining, light straw color or whitish, white at suture; suture deeply and regularly impressed, made conspicuous by the approximating carina; aperture very oblique, roundly ovate, with an angle on outer edge corresponding to the excavated carina, posteriorly sharply

*Magazin de Zoologie, p. 37, Plate xxxvii. (1831.)

†*Vide* American Journal of Conchology, Vol. V., 1869, p. 198, Plate xvii., Fig. 3.

angled, well rounded before; peritreme continuous, almost rimate, closely appressed to parietal wall.

Operculum light corneous, spiral, closely fitting the aperture.

The following account and illustration of the dentition is by Mr. Charles E. Beecher, who has devoted much attention to the dentition of this group:

"Jaw thin, membranaceous.

"Odontophore .62^{mm} in length, and .15^{mm} in width. There are usually fifty-five transverse rows of teeth, arranged according to the formula $3-1-3$, which is common to the family *Rissoidæ*.

"Rhachis distinct, occupying one-fourth the width of the ribbon. Rhachidian tooth (Fig. 1) short and broad, with the infero-lateral angles produced and slightly arcuate. On each side of the anterior face is a strong, short, conical process or basal tooth projecting outward and somewhat downward. Basal margin trilobate; central lobe truncate. Cusp curved forward, and extended into a strong denticle with four smaller ones on each side. The formula of the denticles for this tooth would, therefore, be:

$$\frac{4+1+4}{1+1}$$

"Body of intermediate tooth* subrhomboidal, with the infero-interior angle slightly produced and with an angulation in the margin above. From this point there is a thickening or ridge extending toward the fixed end. Peduncle longer than the body of the tooth. Upper margin abruptly curved forward and marked by seven denticles, of which the third inner one is usually the largest; the formula for this tooth may be written $2+1+4$.

"Inner lateral tooth (Fig. 3) spoon-shaped, with the infero-interior margin angular. Upper anterior margin marked with a fringe of about twenty-four denticles, decreasing in length from the interior extremity. Peduncle straight, wider than the body.

"Outer lateral tooth (Fig. 4) falciform, straight along the peduncle. Anterior margin and extremity denticulated with thirty minute denticles, usually decreasing in length toward the distal extremity, but subject to some variation. The denticulate margin extends more than one-third the length of the tooth. Peduncles slender and nearly straight.

"The formula for the denticles is:

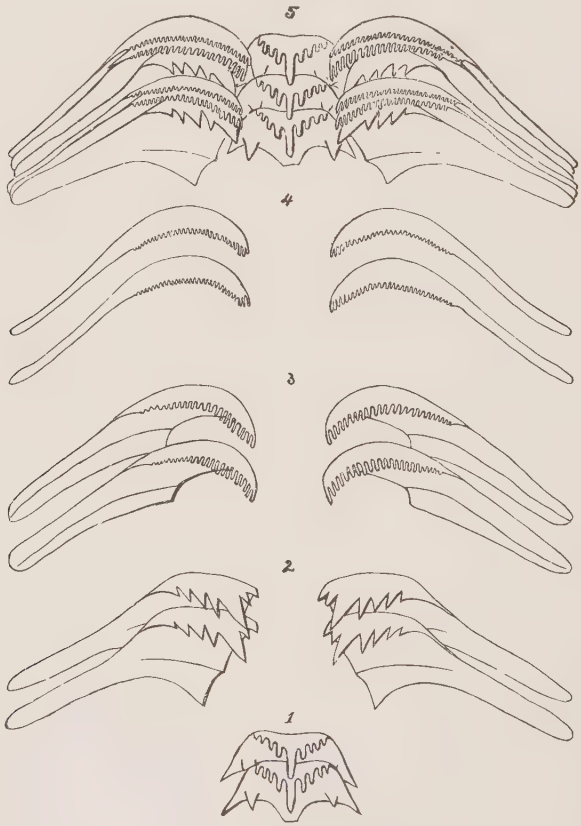
$$30-24-7-\frac{4+1+4}{1+1}-7-24-30.$$

"There is a marked variation in the character of the denticles on the intermediate and lateral teeth. On the intermediate they are large,

*It is proposed by Mr. Beecher and the senior writer to give to this tooth the name of *admedian*. In a forthcoming monograph of the *Rissoidæ* that name will be constantly so employed.

angular, and somewhat irregular. The lateral teeth are uniformly marked by a regular fringe of slender denticles, which are much smaller on the outer lateral.

"Some portions of the membrane and different specimens show considerable variation in the length and strength of the denticles on the lateral teeth, and sometimes their number seems subject to some mutation. The numbers given in the formulæ were averaged from several enumerations, and represent the comparative denticulation of the teeth."



DESCRIPTIONS OF FIGURES.

(All figures enlarged to 500 diameters.)

FIG. 1.—Rhachidian teeth.
" 2.—Intermediate teeth.
" 3.—Inner laterals.
" 4.—Outer laterals.
" 5.—A portion of the odontophore, representing the teeth in their natural position.

This species has a limited distribution, occurring only, so far as present information goes, in North-western Nevada, in Walker and Pyramid Lakes. Living forms have been collected only in the last-named locality.

The description of Dr. Stearns has been amended to form a diagnosis as complete as very extensive series would permit. The shell is exceedingly variable, ranging from short and stout to long and slender, and from strongly carinate to entirely smooth. Figures 6, 7, and 8 of Plate II. show the smooth forms and the variations to which they are inclined.

Pyrgulopsis mississippiensis sp. nov.

(Plate II., Figs. 14-16.)

Pyrgula scalariformis, var. *mississippiensis* Pilsbry.—Am. Nat., Jan. 1886, p. 75. No description.

Shell minute, pupiform, elevated, imperforate; whorls $5\frac{1}{2}-6$, flattened, with a well-marked carina on lower third, which becomes central on periphery of last whorl, body-whorl equal to one-half entire length of shell and bluntly angulated at position of carina; epidermis ———; suture distinct, deeply impressed only at commencement of last whorl and below, above last whorl covered by carina; aperture narrowly ovate, broadly rounded before and narrowly rounded behind, very oblique; peritreme continuous, almost rimate, slightly reflected over the parietal wall; lip simple, sharp.

Animal unknown.

This form has hitherto occurred only in the Mississippi River, near the mouth of Rock River, on the Illinois side — Rock Island County, Illinois. Many dead specimens have been taken, but, as yet, no living ones. It differs in important particulars from the *P. scalariformis*, Wolf, which is "carinate its entire length," has a different aperture, and is markedly different in the character of the sutures. Our species is ecarinate on all whorls above the body-whorl, the carina being depressed and filling entirely the suture. The outlines of the apical whorls are wholly unlike the figured type of Wolf's species. The average measurements of the four specimens upon which the preceding description is based are, for length, 4.66mm; for breadth, 1.61mm. The proportions of length and breadth, while variable, do not vary within so wide limits as the *P. nevadensis*. The individual measurements are as follows:

Specimen	*1.*—	Length,	3.58mm;	breadth,	1.60mm.
"	*2.*—	"	3.38mm;	"	1.56mm.
"	*3.*—	"	3.50mm;	"	1.64mm.
"	*4.*—	"	3.40mm;	"	1.64mm.

Pyrgulopsis spinosus, sp. nov.

(Plate II., Figs. 17–19.)

Shell minute, imperforate, turreted, unicarinate, carina modified into spinous processes on last three whorls, darker colored than balance of shell; whorls 5–5½, first two rounded, destitute of spines or carina, the last three somewhat geniculate, angled at location of carina, body-whorl large, sometimes with an occasional spine below the carina; epidermis light horn color, nearly white at apex, with microscopic longitudinal revolving striæ, shining; aperture roundly ovate, slightly longer than broad, rounded anteriorly; peristome not continuous, sharp, simple, slightly reflected near the columella, suggesting a faint umbilicus; suture slightly impressed.

Operculum spiral, reddish horn color.

Specimen 1.—Length, 3.86^{mm}; breadth, 2.34^{mm}.
" 2.— " 3.00^{mm}; " 1.88^{mm}.
" 3.— " 3.06^{mm}; " 1.52^{mm}.

Habitat.—Comal Creek, a clear stream at New Braunfels, Texas, on rocky bottoms. It was associated with numerous specimens of *Goniobasis pleuristriata* Say, *Amnicola* (species undetermined), and *Bythinella* (species undetermined).

In some particulars this form may be compared with Stimpson's genus *Potamopyrgus*. It differs radically, however, in the character of the spinous processes, which in that type are epidermal, while in our form they are true testaceous products. It is the only spinous rissoid described from the United States.

Pyrgulopsis scalariformis Wolf.

(Plate II., Fig. 13.)

Pyrgula scalariformis Wolf.—Am. Jour. Conch., Vol. V., p. 198, Plate xvii., Fig. 3 (1869).

"Shell turreted, slender; whorls 6, chalky white; suture deeply impressed; carinate its entire length on the lower edge of the whorls; mouth small, ovate, but slightly connected with the last whorl. Length, one-half inch.

"Post-pliocene; abundant on the Tazewell shore of the Illinois River." (Wolf.)

No other locality has been recorded, and no living specimens have ever been taken. The figure is a copy of the original, and has been the main reliance in referring the species to this genus. We have not been able to procure from the author either the types or authentic specimens for examination.

A DEFENSE OF OUR LOCAL GEOLOGY.

BY W. H. BARRIS.

[Being a criticism of a pamphlet on the "Geology of Scott County, Iowa, and Rock Island County, Illinois," by A. S. Tiffany. Originally read as an address before the Academy, it is published in such form, rather than as a more rigidly strict scientific paper.]

Read before the Academy, February 26th, 1886.

It was an unfortunate venture when the author of this pamphlet proclaimed in the "Naturalist's Directory" that his *forte* consisted in "the correct naming of fossils." His friends had a right to expect that in his first paper on the subject, a claim so conspicuously set forth would be fully substantiated. They certainly were not prepared to recognize within a few pages no less than one hundred and eighty blunders in the correct naming of fossils.* The printers of the pamphlet, realizing that their reputation for accuracy might be compromised by the occurrence of such blunders, remonstrated; but they were overruled, and given to understand it was just as it should be.

It certainly was unfavorable for the kind reception of the pamphlet that blunders should be allowed to accumulate in such numbers. One, two, or more, might be overlooked; but the presence of so many errors gives rise, most naturally, to the suspicion that the same want of care, thought, and judgment that led to such blunders, even in the naming of fossils, might equally fail to grasp the nice distinctions on which genus and species are founded; in other words, blunders in the correct naming of fossils might pave the way for blunders in their identification. The suspicion is confirmed by the result.

We are confronted with the statement that from the Corniferous limestone developed in this locality have been gathered over two hundred and forty-six species of fossils. We infer the utter improbability that this number of species are found in this locality, from the following considerations:

First. The character of the rock is against it. Professor Hall, of our first State Geological Survey, writing of the Corniferous limestone of our vicinity, says: "The large amount of shaly matter mingling with the material of the rock, or occurring as shaly seams between the beds, would appear to render the condition of the ancient ocean unfit for the

*The errors noted are distributed as follows, viz.: In the first list, page 7, 44; in the second list, page 17, 57; in the third list, page 24, 45; in the fourth list, page 28, 18; in the fifth list, page 29, 3; in the text, 18; making a total of 185.

development of animal life. In nearly all the exposures observed it contains few fossils."* Professor Hall had access only to the exposures above the city. Since that time quarries have been opened below. The general character of the rock, to some extent, still prevails. That it is unfavorable to the preservation of fossil remains is apparent from the condition in which they are found. It holds them firmly, and gives them up reluctantly. Ground into small fragments before the deposition of the rock, they are compacted into its substance. If large fragments occur, they are generally broken or crushed. Even where a somewhat perfect external form appears, in the majority of cases the finer markings and the delicate organs, on the preservation of which identification depends, are obliterated beyond all hope of restoration. As a general rule, the rarer the fossil the more damaged is its condition. Of the genus *Stereocrinus*, one of our *Crinoids*, of which scattered fragments had been found from time to time, it was not till after six or seven years of exploration that a specimen was found in a sufficiently good condition to warrant description and illustration. In a single instance a reef is formed, abounding in fossils on its upper surface. The most noticeable fact is not the abundance of differing species, but the recurrence of so many individuals of the same species. While they exist in numbers partially weathered, it is to the exclusion of every other form. At the same time, it is so difficult to extricate the individual from the mass, that it would be impossible to find a single well-preserved specimen in any cabinet in the city. From such a character of the rock, we deduce that no great number of species may be expected.

As a *second* consideration, the limited exposures of the rock are against it. In this respect, geologists at a distance, who have never visited us, find it difficult to realize our situation. In proportion as the exposures of a rock are multiplied, extended, as they often are, along a river or some other natural exposure, or cropping out at intervals throughout a State, in that proportion we look for abundance of species. We emphasize this fact. Our whole Corniferous limestone in its fossiliferous portion comprises simply two or three slight exposures above the city — now almost obliterated — a slight show between Rock Island and Moline, also at Milan, and two or three small, insignificant quarries below the city. This is the whole extent of the fossil-bearing limestone as exposed in our vicinity. We are told that out of this have come two hundred and forty-six species of fossils.

* Geology of Iowa, Vol. I., p. 84.

A *third* consideration opposed to such statement is this: The experience of all other geologists is against it. No geologist from abroad ever visited our quarries without a disappointment, both as to the number of fossils obtained and the unsatisfactory condition in which they were found. I might appeal to every member of the Academy who has ever wrought in this rock, as to the want of success that has invariably attended his labors. A whole summer's work may be summed up thus: Much time spent, many visits made, and few fossils found. And hence the universal surprise expressed at the statement of the author of this pamphlet, that in this meagre locality he had collected no less than two hundred and forty-six species of fossils.

Taking into consideration the character of the rock, the fewness of its exposures, the uniform testimony of all other workers in the rock, the statement of the author as to the number of species collected will never be credited by any practical geologist. There will be a suspicion that the number of blunders in the matter of identification will equal, if not far exceed, the number of blunders already referred to.

As a *fourth* consideration, such a number of species is not favored by a comparison of this with other localities. A test case might be reached, could we find elsewhere in the Corniferous limestone an exposure as limited as ours, and with rock of similar character. Failing to do so, and using such material as I have access to, I compare the small with the great. Certain facts in the geology of the State of Michigan may aid us in this matter.

It will be remembered that Professor Rominger, the present State Geologist, has drawn no line between the Corniferous limestone and the Hamilton group, but treats them as one formation. It extends on the eastern shore of Lake Michigan from twenty to twenty-five miles, with a far greater exposure on the western shore of Lake Huron, bordering rivers, inland lakes, and islands. In places, particular exposures are measured, not as ours, by the rod, but by the mile. Professor Winchell, of the first Geological Survey, writes: "Twenty rods west of this locality is a more considerable exposure, extending along the beach for three-quarters of a mile, and forming an escarpment which, at some points, attains an elevation of thirty-five feet."*

Professor Rominger says of Khagashewung Point: "For more than a mile's length it is lined with vertical rock bluffs, about fifteen feet high."†

* Report on the Grand Traverse Region, p. 41.

† Geological Survey of Michigan, by Professor Rominger, Vol. III., p. 58.

These two exposures, in extent of surface, exceed ours a hundred, if not many hundred times. So much for extent of rock.

Another equally important fact is its prevailing fossiliferous character. In many places, limestones and shales are absolutely crowded with fossils, many of which are in an excellent state of preservation. Professor Rominger writes in reference to the shoals near Thunder Bay Island: "The exuberance of fossils is most beautifully exhibited. One sailing on them can see for miles the whole bottom paved with corals in convex lumps, from a few inches to some feet in diameter, their white sparry substance contrasting beautifully with the dark limestone which incloses them."*

Professor Winchell says of a certain coral: "Fine specimens of this coral can be collected in any quantity, even to a shipload."†

With such extensive exposures of rock, in many portions crowded with fossils, we ask as to the number of species that are found. If our meagre exposure, measured by a few rods, affords two hundred and forty-six species and more, may we not expect a proportionate increase in number with miles of exposure, its profusion of fossils, two of the most accomplished geologists of the day engaged in the survey, and the wealth of the whole State of Michigan to back them in their work? What is the result? Professor Winchell thus writes: "The table which follows embraces a list of all the fossils thus far collected, including the collections of my recent survey, and those heretofore made by State authority."‡ That list furnishes ninety-two species. In addition to these, Professor Rominger enumerates seventy-five more. Thus the results of the two geological surveys of Michigan are one hundred and sixty-seven species. In other words, the whole State of Michigan has furnished not far from two-thirds as many species as are found in our few small quarries and neighboring exposures. Is it probable?

The same survey furnishes us with another equally pertinent illustration. A family of corals, known as the *Cyathophyllidæ*, exists in the Hamilton of Northern Michigan, at times in as wonderful state of perfection as when the *polyp* lived in its cell. In this locality the whole internal cavity is filled with foreign material which cannot be removed without injury to the structure, and yet on this internal portion, more than any external character, the identification of this class of corals depends. Of this one family of the *Cyathophyllidæ*, in its two members of

*Geological Survey of Michigan, by Professor Rominger, Vol. III., p. 47.

†Report on the Grand Traverse Region, by Professor Winchell, p. 41.

‡Report on the Grand Traverse Region, p. 85.

Cyathophyllum and *Zaphrentis*, Professor Rominger has noted and illustrated nine species, and Professor Winchell about six, making a sum total of fifteen. This pamphlet credits our limited locality with thirty-three — more than twice as many as are found in the whole State of Michigan.

I pause for a moment over another feature of this pamphlet. It is admitted that certain fossils not only have a wide range, but reappear in successive formations. But it is an unheard of phenomenon, until this pamphlet broached it, that, in any locality circumscribed as ours, out of two hundred and forty-six species, one hundred and fifty-nine are characteristic of the Corniferous limestone, and eighty-seven are representatives of other and distant rocks. It reaches the proportion of almost two-thirds of the whole number reported as found. Call the roll, and Trenton responds, 1; Clinton, 3; Niagara, 14; Guelph, 1; Lower Helderberg, 5; Onondaga, 3; Schoharie Grit, 7; Oriskany, 3; Corniferous, 159; Hamilton, 35; Tully, 2; Chemung, 2; Burlington, 1; Upper Helderberg, 2; Marcellus Shale, 2; 28 so unfortunate as to be unnamed.*

That such a heterogeneous assemblage should mass itself within the compass of our few quarries is an anomaly having no parallel within the range of geological investigation.

The identification of fossils is a work of acknowledged difficulty, even with the best of facilities. In proportion as there is a deficiency in authorities and means of comparison, especially if the fossils are in a poor state of preservation, the difficulty is greatly enhanced. Illustrations of this difficulty abound. One can scarce go amiss for them.

Professor White, of the Smithsonian Institution, gives two figures of a certain coral so common that ninety-nine out of a hundred collectors would not hesitate to name it. He declines either to describe or identify it, on the ground of the necessity of a thorough revision of the fossil corals of our country, and the consequent doubt that is naturally felt as to the correctness of specific determinations by means of merely the external features. External characteristics, it is true, will always remain valuable aids in the specific determination of fossil corals; but in the present state of paleontological science one is not justified in omitting microscopic and other details of internal structure.

Professor Worthen, of the State Geological Survey of Illinois, thus writes of a certain spirifer: "This shell seems closely allied to several

* Pamphlet, p. 19.

forms described by Professor Hall under other names, but not figured. Until all these have been fully illustrated, it is impossible to make detailed comparison without specimens of all these forms." *

In the State of Michigan a particular shell abounded to such an extent that the rock containing it took its name from the shell. It was known as the *Tropidoleptus* bed. Subsequently, Professor Winchell writes: "The term *Tropidoleptus* beds is changed to *Bryozoa* beds, since the supposed *Tropidoleptus* proves to be a *Strophodonta*, an entirely different species." †

Professor Hall, of the State Geological Survey of New York, has more than once claimed that other paleontologists had entirely misunderstood his descriptions. They had not only failed to identify, but out of fossils he had described they had made new genera as well as species. In the twentieth report on the New York State Museum of Natural History several pages are devoted to such controversy.

These are representative men — acknowledged authorities in all that pertains to the science of paleontology. Was there ever a more uniform testimony than that which is thus borne to the difficulty of determining species?

Will not errors increase in proportion to our lack of these opportunities? With limited means, limited time, limited education, limited experience, limited libraries, and limited cabinets of fossils, will not our work show the effect of such limitation? Errors will and must abound. Is this work of identifying two hundred and forty-six species from our few quarries a perfect work? Is this pamphlet an exception to all other writings on paleontology?

I put in compact shape the points on which I have touched:

It is improbable that such a number of species should be found in the Corniferous limestone of our vicinity, for these reasons:

First. Because of the character of the rock.

Second. Because of our very limited exposures.

Third. Because their occurrence in such numbers is against the experience of every other worker in our rocks.

Fourth. Because, in comparison, Cook's quarry and vicinity are made to furnish one and a half times as many species of fossils, and twice as many of a certain species of coral, as have been discovered by the two geological surveys of the State of Michigan.

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* Geological Report of Illinois, Vol. III., p. 434.

† Geological Report on the Grand Traverse Region, p. 84.

Fifth. Because the testimony of the most distinguished paleontologists of our day is that the difficulty of determining species is so great that errors in identification abound under the most favorable circumstances.

This improbability accumulates with each consideration, till we do not hesitate to say that, in our limited exposures of the Corniferous, two hundred and forty-six species never have been, and never will be, realized. In the list occurs the names of fossils that are not found within five hundred miles from Davenport.

I have thus spoken of the paleontology as set forth in this pamphlet. I pass to a consideration of its geology.

This pamphlet is as significant in what it leaves out as in what it puts in. On page 19 we read: "No fossils have been published as having been collected in the Corniferous or Upper Helderberg, in either of these counties, in the Iowa or Illinois geological reports." The inference is plain that, since the publication of those reports, no investigations have been carried on in the geology of our locality, except those proclaimed in this pamphlet.

Some years since the Academy published papers on our local geology, accompanied with illustrations and descriptions of new fossils. We place side by side some of the statements made in those papers and in this pamphlet — the likeness is suggestive:

Those papers first gave to the quarries below the city the name "Corniferous." This pamphlet says, "Corniferous."

Those papers first divided the rock into two parts — the fossiliferous and the non-fossiliferous. This pamphlet accepts such division.

Those papers first defined the extent of the fossiliferous portion. This pamphlet recognizes the same boundaries.

Those papers stated that the Cathedral was built of the non-fossiliferous rock found above the city, and Trinity Church of the fossiliferous rock found below the city. This pamphlet says, "Churches and dwellings are built of this stone."

Those papers characterized the rock as most durable. This pamphlet says, "It shows no signs of disintegration after thirty years exposure."

Those papers first noted the frequent recurrence of large, cavernous openings of greater or less extent. This pamphlet speaks of "numerous large pot-holes excavated in the Corniferous limestone."

Those papers stated that these cavities were filled with sand and shale from the coal-measures. This paper says "filled with arenaceous shales of the coal-measures."

One can scarcely tell which is which. He is reminded of the Siamese twins, Chang and Eng, with only this difference, that the papers of the Academy were born several years in advance of this pamphlet. Indebted, as it is, to the Proceedings of the Academy for the facts presented, the conclusions reached, and adopting, to a great extent, its very language, would not the commonest courtesy suggest an acknowledgment of such indebtedness? Why no recognition of those papers? Simply because to ignore the work done by the Academy would give a certain notoriety to the pamphlet that would attract attention as the *only* work done in our local geology since the publication of the last geological surveys, to which the author of this pamphlet is plainly indebted for much of what value it possesses, but which he chooses to utterly ignore, instead of acknowledging his indebtedness thereto, as simple justice demands.

It is folly thus to attempt to ignore the work done by the Academy. In this, as well as all other departments of scientific research, it has sought the truth for the truth's sake. It has done good work in various branches of scientific inquiry. It has made stable additions to the sum total of exact science. It has gathered rich treasures of material and intellectual wealth, and it proposes to care for and defend them. It cannot afford to let this pamphlet go out as by a member of the Academy, without a protest against its scientific inaccuracy and its misleading inferences.

VOLCANOES OF THE SANDWICH ISLANDS.

BY C. S. WATKINS.

Read before the Academy, May 28th, 1886.

THE newspapers announce that the lake of lava at the volcano of Kilauea, Island of Hawaii, Sandwich Island group, has recently disappeared, leaving only a bottomless pit, where formerly, even in its quiet times, a pool of liquid, molten, almost boiling lava, about seven hundred yards in width, has been.

As I visited those regions in 1854, and noted some facts that seem to bear upon this subject, and that I have never seen stated or referred to by other visitors, it has occurred to me that, just now, a report of my observations may not be out of place.

Preliminary.—The entire Sandwich Island group is very evidently of volcanic origin, and of regular succession in order of creation. From the extreme north-western end of the group to and including Hawaii —the last of the cluster—a distance, in an almost straight line, of about four hundred miles, in a nearly south-easterly direction, each successive island is larger, the intervening distance between the centres is greater, and the volcanic remains evidently of more recent origin than at its immediate predecessor. In this rough statement the three or four smaller islands near Maui are regarded as merely detached portions of the main island.

The group begins at the north-western end with a nameless, uninhabited, and almost submerged, nearly level island, the composition of which is evidently the usual lava and cinder scoria resulting from volcanic fires. In size the visible portion of this is scarcely a mile in diameter. About ten miles south-east from this point is Nihau, twelve miles in diameter, hilly, with lava rocks, but no traceable volcanic cones or mounds. Twenty miles south-east, or nearly so, is Kaui, the first inhabited island. Kaui is twenty miles long, ten miles wide, and the hills and rocks testify very plainly to their volcanic origin. Thirty-five miles from Kaui, in the same continuous line, is Oahu, twenty-five miles in diameter, and with unmistakable evidences of much more recent creation. Honolulu, the capital city of the Hawaian kingdom, is on this island. Within a radius of five miles from the city are at least seven volcanic mounts, one or two hundred feet high, and with clearly defined craters in good preservation. Next, at a distance of about fifty miles, is the island of Maui, on which is the

town of Lahaina, a seaport of considerable local commerce. Maui is twenty miles in width and fifty miles in length, and, strictly described, is really a union of two separate islands of nearly equal size with three or four smaller islands—evidently offshoots—within a few miles. Here the majestic, volcanic cone, Haleakala, ten thousand feet in height and as clear-cut as if but lately made, is the leading feature. Although a dozen or more of sub-volcanoes have had outbursts on its sides and at its base, yet the symmetry of the original cone is unimpaired. Up to, and including, this island, there are no active volcanoes; and even the traditions of the natives have no allusion to such disturbances. In fact, it is decidedly questionable if human life could have existed on any of the islands thus far spoken of until so long after all volcanic action had ceased thereon that the lava had become sufficiently decomposed by the influences of "climate and time" to have formed a soil sufficient for a permanent growth of vegetation.

Nearly one hundred miles from Maui, still south-east, is Hawaii, the largest and, thus far, the final island of the group. Hawaii is seventy-five to one hundred miles in diameter, very rocky and hilly, and, until a few months, had the volcanic influences still active and visible. On Hawaii are the old, extinct volcanoes, Hualalai, fourteen thousand feet in height; Mauna Kea, sixteen thousand feet; and Mauna Loa, seventeen thousand feet from the sea level to its summit. These three are evidently of successive formation, and each is clearly defined as if created in the present century. It may convey an idea of the magnitude of one of these to state that the crater of Mauna Loa is seven miles in diameter and one and a half miles in depth—large enough to receive and conceal our Mt. Washington, if inverted, into its cavity. No eruptions at either of these summits have occurred in at least the past hundred years. The volcano of Kilauea, from which all modern outbreaks have proceeded, is really a side issue of Mauna Loa; and its crater, about one mile in diameter, is at an elevation of nearly five thousand feet above the sea level. The lake of liquid lava of which we read was about two thousand feet in diameter, and it was from this source that all the eruptions of late years have proceeded.

And now, having given a rough-drawn and non-scientific outline description of these islands, I come to the feature which induced this writing. Several years previous to my visit in 1854, captains of vessels had, on repeated occasions, reported having passed through waters in violent agitation, in calm weather, and had suggested that this agitation was caused by a sub-marine volcanic eruption, active at the bottom of the sea; and each of these reports located the disturbance as being

about five hundred miles south-east from Hawaii. It was also noticed that, at about the dates thus mentioned, "tidal waves" of enormous size and power washed both shores of the Pacific almost simultaneously, thus manifestly originating at a common central point, which, as near as could be estimated, was not far from the region of the above-reported sub-marine volcano.

The specific point to which, it seems to me, intelligent attention might appropriately be directed, is as to whether the indications and disturbances thus known during at least forty years, taken in consideration with the recent disappearance of the lava lake at Kilauea, and with the herein described formation system of the existing islands, justify the suspicion that the Sandwich Island group may, at no distant day, have an addition to its number. If so, it may then be of scientific interest to have an accurate investigation of the points I have herein called attention to, as to the comparative and successive increase in size and distance of each island. However, at this time I am only "placing on file" this rough exhibit. Many years may pass before the subterranean machinery will make another chapter of this history possible.

And now, in conclusion, while on this subject, I may state another puzzling feature, though of a philosophical and speculative, rather than of a scientific, character. I must, as a prelude, say that I was on the Islands on a roving tour, about three months, and acquired quite a mastery of the simple language of the islanders (eighteen letters compose their entire working alphabet), and thus got much information direct from the natives. One story I found so unvaryingly told in all the Islands that there can be no doubt as to its antiquity. It was this: "The volcanic outbursts at Kilauea are caused by the ebullitions of "wrath of the goddess Pele — the long, fine, grass-like substances thrown "out at such times are 'Pele's hairs,' torn by the angry goddess from the "heads of those of her subterranean subjects that she at such times gets "her hands on. This goddess Pele was once a queen in Heaven, but, "having got into a row with the head of the family, was, after a series of "revolutionary conflicts, conquered and ignominiously banished to the "lower regions, etc., etc." Captain Cook found this tradition prevailing at the time of his discovery of the Islands, and it is still firmly believed. It really seems that John Milton's patent on the central idea of Paradise Lost could be successfully contested by the king of the Sandwich Islands as heir to the belongings of his Kanaka ancestors.

I have only to add that, writing from memory of the rambling observations made thirty-two years ago, I cannot aver that the directions and dimensions herein given are closely accurate. The outline features, however, as I have stated them, are unquestionably, in a general way, correct.

HARFORDIA, Greene & Parry.

A New Genus of Eriogoneæ, from Lower California.

BY C. C. PARRY.

Read before the Academy, July 9th, 1886.

WHILE the remarkable Eriogonous genus *Pterostegia*, Fisch. & Meyer, has been long known among botanists in a very common California species, *P. drymarioides*, F. & M., a second species from Lower California, collected in one of the early voyages of discovery on the Pacific coast, and described in "Botany of the Sulphur" as *Pterostegia macroptera*, Benth., has been long a *desideratum* in scientific herbaria. Only as late as 1882 additional material was procured by Mr. L. Belding from near the original locality, and fragmentary specimens of the same were contributed to the Gray Herbarium, at Cambridge, Massachusetts. The year following a single fruiting branch was presented to the writer by Gen. William Le Duc, who, attracted by the showy involucre, put a fragment in his pocket-book while on a mining excursion down the Lower California coast in the spring of 1883. In the spring of 1885, Prof. E. L. Greene, of the California Academy of Science, in his interesting botanical trip down the Pacific coast as far as Guadaloupe and Cedros Islands, secured ample specimens of what, on subsequent examination, he regarded as two distinct species, which were described by him in Bulletin of the California Academy, IV., pp. 212, 213, as *Pterostegia galioides* and *P. fruticosa* — not being aware at the time that the former was identical with *P. macroptera*, Benth., which, according to the published descriptions, represented only a low herbaceous plant. Unfortunately, owing to the lateness of the season, Mr. Greene's specimens did not contain the characteristic flowers, his description of the floral organs being derived only from the fallen fruit. Previously, however, Mr. Greene, as Botanical Curator of the California Academy, had found in Dr. Veatch's collection of 1859, from Cedros Island, a single fragment of one of the above species, so characteristic, as he afterwards noticed, of the peculiar vegetation of that island. Before, however, reaching the conclusion, from the data then in his possession, of including these remarkable plants in the genus *Pterostegia* — so different in habit and general character from the typical species — Mr. Greene intimated a probability that more complete material, including the floral organs, might justify the establishment of a new genus, for which he

suggested the name HARFORDIA, in compliment to the long-time efficient Curator of the California Academy of Science, and for many years previously a zealous collector of Pacific coast botany — Mr. G. W. H. Harford. Now, at last, as one of the fruits of the present season's (1886) collections, I have just received from my zealous correspondent, C. R. Orcutt, of San Diego, lately returned from an extensive and arduous land trip into the arid districts of Lower California, complete flowering specimens of one of the species above referred to, being identical with the *Pterostegia macroptera*, Benth.; *P. galioides*, Greene. From the specimens thus obtained, a careful examination reveals such remarkable and unexpected floral characters, that, fully confirming the surmises of Mr. Greene, will require the establishment of a new genus, which, in cordially carrying out his suggestions, I venture herewith to characterize, viz.:

HARFORDIA, Greene & Parry.

Dicœcious! rarely monœcious; pistillate flowers single, involucrate; involucre monophyllous, the folded edges forming a winged central crest, laterally bilobed and gibbously bisaccate, accrescent in fruit, hyaline and reticulated with deep red veins; staminate flowers without involucre! in axillary clusters on an irregular axis, more or less prolonged; pedicels jointed at the summit, hispid below; perianth 6-parted, stamens 6–9, in two rows, anthers oval; pistillate flowers persistent, much shorter than the developed akene, 6-parted, with 9 staminodes in two rows at the base; styles short, recurved, stigmas capitate; akene smooth, oblong, acute narrowly winged; embryo axile, excentric, radicle as long as the oval cotyledons. Suffruticose or shrubby perennials, with jointed stems, opposite connate leaves, dichotomously branched, with irregular fasciculate leaves, and flowers in the upper axils. Differs from *Pterostegia* in its perennial habit, its axile excentric embryo, and from all known *Eriogoneæ* in its dicœcious flowers. Confined in its geographic range to the arid districts of Lower California, and adjacent islands.— *Pterostegia*, Benth. & Hook., Gen., Pl. III., p. 94, in part.

Two species, viz.:

1. H. MACROPTERA.— *Pterostegia macroptera*, Benth., l. c.— *P. galioides*, Greene, l. c.

Suffruticose, diffusely branched from a thick ligneous axis, hoary with appressed pubescence, branches slender, jointed, with swollen nodes at the junction of the opposite connate sessile leaves; leaves entire

thickish, narrowly spathulate, one-fourth to one-half inch in length; involucre broadly bilobed, and conspicuously inflated on each side, hyaline with deep red reticulations; staminate flowers axillary, on a more or less prolonged axis, without bracts, except an irregular ciliate tuft at the base of the pedicels; perianth short-campanulate, deeply 6-cleft, segments nearly equal; stamens 9, in two rows, at the base, with occasional traces of undeveloped ovaries; pistillate flowers shorter, persistent, and adhering to the developed akenes, 6-parted, with two rows of pedicellate staminodes at the base; akene and embryo as above noted.

Habitat.— Lower California, from San Quentin to Magdalena Bay, flowering early in the season; staminate plants more diffuse, with shorter joints and less prolonged branches. Mr. Orcutt's specimens, No. 1374, April 17th, 1886, from San Telmo, show all the peculiar characters of this species.

2. H. FRUTICOSA, Greene, ined.— *Pterostegia fruticosa*, Greene, l. c. (Copied from Mr. Greene's original description, Bull. Cal. Acad., IV., pp. 212, 213.)

"Shrubby, diffusely branched, firmly erect, 2–4 feet high, densely leafy; branchlets short-jointed, tomentulose at the joints; leaves glabrate, fleshy, obovate-spathulate, entire obtuse or retuse, 2–5 lines long; involucre firm-hyaline, reddish, with darker reticulate veins, 5–7 lines long, deeply cleft into two entire reniform lobes; wings reniform, entire unequal; akene ovate, lanceolate two lines long, sharply triquetrous; perianth a half line long, persistent."

Habitat.— Cedros Island: Dr. Veatch, 1859; E. L. Greene, May, 1885. Not feeling at liberty to modify Mr. Greene's original specific description in referring it to his proposed new genus, it is only necessary to add that, in the absence of staminate flowers, it can only be provisionally attached to this genus by its close similarity to the preceding species till confirmed by complete specimens.

AN ANCIENT MINE IN ARKANSAS.

BY WM. A. CHAPMAN.

Read before the Academy, May 28th, 1886.

In the spring of 1884, while engaged in prospecting for minerals over the southern portions of Polk County, Arkansas, my attention was directed to an excavation, supposed by those who now reside in that locality to have been the work of Spanish miners, who, local traditions state, were once actively engaged in the exploration of this State for gold and other precious metals. My curiosity regarding this so-called Spanish mine being aroused, I decided upon a visit to it, in order to determine, if possible, who the miners were and what had been the object of their labor. After going about two miles north-west of Hatton post-office, I came to a spur-like appendage of the mountain, which, jutting out from the main range, formed one side of a narrow, gorge-like valley, through which, in times past, a stream of considerable size had wound its way. Through the erosion of water, a part of this hill had been removed, in such manner as to give to one facing the opening the impression that the dip of the exposed strata was in two directions. It was evident that this face of the hill had once been an overhanging cliff, with all the members of the series of rocks entering into its structure fully exposed; but the falling of the overhanging mass and the accumulation of rubbish from the mine have in a measure restored the base, and now conceal the greater part of the strata from view. The strata open to inspection — some twenty feet — are metamorphic sandstones, ranging in hardness from a soft, friable, amorphous sandstone to that of a quartzose rock of crystalline structure, suitable for millstones. These form the mass of the exposed strata. Above them are others which have distinct cleavage lines at right angles to each other, and which, under atmospheric influences, display a tendency to part along the cleavage lines. Interstratified with these are irregular masses of hornblende and a white, close-textured rock resembling novaculite. The thickness of the strata varies from two to twenty-six inches. The strike of the series is 10 degrees north of east; the dip, northward at an angle of 45 degrees.

The mining operations had been confined to the removal of a single stratum — the lowest of those open to inspection — portions of which

had been left at short intervals as supports to the rock above. The opening to the mine began at a point about twenty feet below the summit of the hill, and extended from thence diagonally downward for a distance of forty feet. A superficial examination convinced me that iron tools had not been employed in the removal of the rock, and hence it seemed exceedingly improbable that the opening before me was the result of European labor. Believing the discovery to be of some importance from an archæological point of view, I proceeded to make a thorough examination of the excavation, a task rendered comparatively easy, as the greater part of the debris had been removed a short time prior to my visit by a person who was in search of silver ores.* Provided with a candle and a slender pole, I descended into the opening, which is about two feet in width, and found that for a depth of eight feet no effort had been made to enlarge the opening by the removal of either of the adjacent strata, both of which are exceedingly hard and quartz-like in structure. The miners, at this point, had ceased to drift upward along the strata, and had commenced the sinking of a narrow shaft. After removing the rubbish from this shaft, its depth was found to be less than five feet. Evidently, the intention of the miners, in sinking this shallow shaft, had been the formation of a face or breast in the rock, to serve as a starting-point from which they might tunnel in an opposite direction to that pursued in the drift above, for, opening out from the bottom of this shaft, was a low passage leading down and under the mountain. After carefully exploring as much of this passage as was within reach of my pole, I proceeded to enter, but, in order to do so, was obliged to go upon all fours. Crawling in this manner for some four or five feet, the passage was found to increase in height to such an extent that an upright position would have been possible, had it not been for the incline of the strata and the narrowness of the passage. The descent here was at a sharp incline, and had been accomplished by means of shelf-like offsets cut into the rock. Traces of fire were plainly visible in and upon the rock at the entrance to the tunnel, and the smoke-blackened walls were so seamed and checked by cracks and crevices as to demonstrate the alternate use, by the miners, of both fire and water in their efforts at breaking down the rock. A further search revealed the mineral *desiderata* of the miners. The soft, friable sandstone, to the removal of which the miners had confined their efforts,

*The alterations effected by that individual, in the appearance of the mine, were of no importance, inasmuch as they were confined to the surface and related entirely to the removal and replacement of a part of the stone supports by others of wood.

proved to be the vein-stone. In it were pockets or cavities filled with a black and a red mineral substance, both pulverulent in form. Descending a few steps farther, my progress was arrested by a large rattlesnake, which I left unmolested in full possession of the lower depths of the mine and the treasures it might contain, and hastily made my way upwards. The black mineral substance proved, upon subjecting it to a qualitative test, to be sesquioxide of iron, with traces of manganese. That these minerals, in the form here found, were those sought for by the miners is evident, as in the near vicinity of the mine are large quantities, exposed, of hematite, limonite, pyrolusite, and psilomelane, which could have been secured at a far less expenditure of labor. That these minerals were of great importance in the domestic economy of the mining people is none the less evident in view of the excessive labor and hardships undergone in its acquisition.

The peculiar method of mining, together with the absence of those markings which would inevitably have followed the use of iron tools, demonstrate that the work was not that of civilized man. Neither will those who are conversant with the characteristics of Indian peoples (applying the term in its generally accepted sense) admit that the excavation was the result of their labor. That the labor was that of some aboriginal people is most evident, and that they were of those whom we know of as Mound-builders is exceedingly probable, inasmuch as there are, within a few miles of the mine, abundant traces of the presence of that people in times past. To these evidences, which seem to designate the Mound-builders as the miners, has been added the following data, obtained while exploring a mound some eight miles distant from the mine. This mound was apparently of very recent origin. (Sketches of it, with such data as I succeeded in collecting, and some of the relics found in it and in the mine, were forwarded by me to the Smithsonian Institution.) In construction it differed materially from all I had heretofore seen. In it, among other relics, were fragments of pottery of a purple-black color. A portion of this coloring matter, when subjected to a qualitative examination, gave results precisely the same as those derived through the analysis of the mineral procured from the mine. The only difference in the two substances I was able to detect, through means then at my command, was the presence of carbonate of calcium, magnesia, and alumina in the coloring matter of the pottery. The presence of these substances, however, is easily accounted for, as, in the endeavor to procure a sufficient quantity of the coloring matter of the pottery for analysis, portions of the

pottery itself were unavoidably included. Those three substances, with silica, are the ingredients of the material used in the manufacture of the pottery — the first two (carbonate of lime and magnesia) in the form of pulverized shells. From the foregoing it would seem that the mineral procured from the mine had been utilized (in part, at least) as a pigment.

Future explorations in the ancient mines and in the numerous mounds of this State will, no doubt, give much additional light upon this and other matters relating thereto; and from the success which has attended the efforts of those engaged in such explorations here, it is by no means improbable that when these extensive and, as yet, almost unexplored fields of research are entered by those whose means will permit them to diligently and systematically prosecute this branch of scientific research, Arkansas will, in their hands, prove fruitful in the yielding of invaluable and, perhaps, unexpected results having an important bearing upon the elucidation of the history of the Mound-builders.

DESCRIPTION OF A NEW HYDROBIA, WITH NOTES ON OTHER RISSOIDÆ.

BY HARRY A. PILSBRY.

Read before the Academy, July 30th, 1886.

Hydrobia texana, sp. nov.

(Plate III., Figs. 1–6.)

SHELL small, conically elevated, rather acute, thin; whorls five to six, convex, lightly striate transversely, with numerous coarse, irregular, revolving striæ, becoming less distinct on body-whorl; sutures well impressed; aperture ovate, somewhat angled posteriorly, rounded before; peritreme simple, acute, not sinuous, adherent to body-whorl, sub-reflexed at the narrow but well-defined umbilicus. Epidermis dull greenish-brown or gray; operculum ovate, sub-spiral, corneous, closely fitting the aperture, with coarse wrinkles radiating from inner margins of whorls; polar point close to columella. The measurements of three specimens are as follows:

a. Length, 4.50^{mm}; breadth, 2.50^{mm}.
b. " 3.45^{mm}; " 1.98^{mm}.
c. " 4.00^{mm}; " 2.00^{mm}.

Habitat.— Guadalupe River and its tributary, Comal Creek, Comal County, Texas.

The spiral striæ are irregularly developed, the upper ones being most constant. On some specimens there is a more prominent, slightly nodose, revolving line above the periphery. Specimens may be seen in the collections of the Davenport Academy of Natural Sciences, the Philadelphia Academy of Sciences, and of the writer. The revolving sculpture at once distinguishes this species from the *Hydrobia seemani* of Frauenfeld,* which it resembles somewhat in outline. A comparison with Frauenfeld's figure shows the Texan shells to be of slightly stouter form. It is quite distinct from other described American species. The specimens were found on the under side of stones in rapidly flowing water. Its associates in Comal Creek are *Goniobasis pleuristriatus* Say, *G. comalensis, sp. nov.*, and an undetermined *Amnicola.*

*Described from Durango, North-west Mexico. *Vide* Verh. K. K. Zool.-bot. Ges., Wien, p. 1025, 1863, also p. 505, 1865 (figured).

This species is placed in Hydrobia because I do not know what other disposition to make of it. It is, perhaps, congeneric with such species as *Amnicola floridana* Frauenfeld,* which has a more acute apex than Bythinella, and is slenderer than Amnicola.

Note on *Pyrgulopsis spinosus* Call & Pilsbry.

I find that this species has no affinity with the other shells included under *Pyrgulopsis*. Its position seems to be in *Potamopyrgus* or in an as yet undefined genus. *Pyrgulopsis* C. & P. is, perhaps, in characters of shell, not separable from *Lyrodes* of Doering, the description of which I had not seen at the time *Pyrgulopsis* was proposed. A thorough examination of the anatomy of these snails, and comparisons with that of *Pyrgula s. s.*, must be made before the true value of all these groups can be determined. To facilitate comparisons by those who do not have access to the publications containing Mr. Doering's papers on mollusca, I copy here his diagnosis of *Lyrodes*:†

Testa subperforata elongata, ovato-conica, tenuis, hyalina, carinata, sæpius aculeata, vel spiraliter lineata.

Animal pede oblongo, antice sublyræ-formi, lobis duo in corpore retractilibus; postice lanceolato; tentaculis subconicis, baculiformibus; rostro brevi.

The type is *L. guaranitica* Doer. The old species *Paludestrina andecola* D'Orb., included by Stimpson in *Pyrgula*, and *Paludina coronata* Pfr., are placed by Doering in the group. The animal resembles *Pyrgula bicarinata* as described by Moquin-Tandon in external characters, the foot being bluntly bilobed before — not distinctly auriculated, as in *Bythinella*, *Amnicola*, and other genera.

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* *Hydrobia wetherbyi* is probably a *Gillia*.

† Boletin de la Academia Nacional de Ciencias en Cordoba, Tomo VII., 1885, p. 461; *L. guaranitica* figured on p. 463.

LASTARRIÆA, Remy.

Confirmation of the Genus, with Character Extended.

BY C. C. PARRY.

Read before the Academy, October 29th, 1886.

As long as the Eriogonous genus *Lastarriæa*, Remy., of the Pacific coast of North and South America remained monotypic, and exhibited several apparently anomalous and puzzling characters, it seemed natural, and perhaps excusable, to endeavor to reduce it to systematic arrangement, even by a somewhat forced and obscure construction. Accordingly, the writer, in a recently published memoir on *Chorizanthe* (Proc. Dav. Acad. Nat. Sci., Vol. IV., pp. 45–63), on a careful examination of all the material then at his command, adopted, and has since maintained, the view that the floral organ representing the perianth of previous authors, presenting some of the external characters of a Chorizanthoid involucre, was actually such, and that the perianth proper was in this case reduced to an obscure lobed ring, adnate to the involucre, on which the stamens were inserted — thus merging the genus into *Chorizanthe*, as *C. Lastarriæa.*

On receiving, lately, from my esteemed correspondent, Prof. Fredrico Philippi, of Santiago, Chili, S. A., a nearly complete set of Chilian *Chorizanthes* — including, with the original, two new species of *Lastarriæa* — a reconsideration of the whole subject was naturally brought up, leading to the following important results:

While the two new species indicated by Professor Philippi conform closely to the published generic character, they do not sustain the views adopted in the paper above referred to; at the same time the specific differences bring more clearly to light other characters, heretofore obscure, which removes at once the most anomalous features of the genus as before understood, exhibiting a clearly defined involucre, enclosing the proper perianth! Thus the five subtending cauline bracts, which in the well known species *L. Chilensis* seem united in a single whorl, in the new species, *L. stricta*, Philippi, show a clearly defined *double* series, including two outer, subtending each dichotomous branch, and comprising the ordinary cauline bracts; three inner, more closely united at base, enclosing a perianth, and therefore representing a proper involucre, not unlike that of *Chorizanthe, polygonoides.* In following this clue, it is not difficult to see even in the closely blended

bracts of *L. Chilensis* also a double series, only obscured by the close similarity of the separate segments.

It thus appears that the suggestion of Professor Gray, contained in a notice of Xantus' plants, as early as 1860, stating that "the verticillate upper leaves of *Lastarriæa* answer to the involucre, which however encloses a proliferous shoot as well as a flower," contains at least half the truth; also the lately published remark of Mrs. Curran (Bull. Cal. Acad., No. V., p. 2,) that "the enclosing bracts of *Lastarriæa* have as much right to the rank of an involucre as those of *Oxytheca, luteola*," may, with the explanation now given, be accepted as nearer the truth than the previous theory of the present writer. With the facts thus brought to light by the interesting discoveries of Professor Philippi, the genus *Lastarriæa*, Remy., may be more clearly defined as follows, viz.:

LASTARRIÆA, Remy.—*Chorizanthe Lastarriæa*, Parry, l. c.

Involucre triphyllous, united at base, segments unequal, more or less thickened and cuspidate-uncinate, closely sessile in the axil of opposite cauline bracts subtending the dichotomous branches and terminal shoots; perianth triangular, coriaceous, 5–6 parted, segments uncinate (resembling the involucre of *Chorizanthe*); stamens 3, inserted on the throat, filaments short, anthers oval; styles short, recurved; akene triangular, embryo straight, with linear cotyledons, and short radicle.

Slender jointed annuals of the Pacific coast of North and South America; differing from *Chorizanthe* only in its 3-bracteate involucre, and its coriaceous, uncinately awned perianth; nearest to Sect. *Acanthogonum*, but differs in its straight embryo.

Three ? species.

1. L. CHILENSIS, Remy.—*Chorizanthe Lastarriæa*, Parry, l. c.

Involucral whorls closely adherent, and similar to the external cauline bracts; perianth sharply triangular, coriaceous, segments unequal, with prolonged uncinate awns.

Habitat.— Pacific coast of North and South America.

2. L. STRICTA, Philippi, ined.

Involucral whorls distinct from the outer cauline bracts, segments broadly oval, retuse, thick-fleshy corrugated, with a prominent keel terminating in a short recurved cusp; perianth membranaceous, segments nearly equal, spathulate, and shortly uncinate.

Habitat.—Coquimbo, Chili, S. A. Professor Philippi, 1885.

3 ?. L. LINEARIS, Philippi, ined.

Smaller, with more linear bracts; hardly distinct from the last.

Habitat.—Coquimbo, Chili. Professor Philippi, 1885.

MOUND EXPLORATIONS AT TOOLESBORO, LOUISA COUNTY, IOWA.

Read before the Academy, August 2d, 1886.

THE village of Toolesboro, locally noted for its prehistoric mounds, is situated on a commanding bluff, about two and a half miles above the mouth of the Iowa River, which empties into the Mississippi fifty-two miles below Davenport.

A party from this Academy had opened some mounds here in 1875, obtaining from them a number of interesting relics (see Proc. Dav. Acad. Nat. Sci., Vol. I., p. 106); but, as several of the group remained unexplored, we decided to make another expedition, devoting a week to the trip and the work. Accordingly, on Saturday, July 24th, we started by skiff, carrying camp equipage, etc., and were on hand, ready for work, Monday morning.

The bluff at this point rises two hundred and ten feet above the Mississippi level, and commands a most magnificent view up and down and across the broad valley common to the two rivers. Extending along its brow, through the north-western outskirts of the village, is a row of nine* large mounds, from fifty to three hundred feet apart, some of which, as stated, had been more or less thoroughly explored — one of them (No. 6) having been entirely removed by Mr. Pratt and his party, leaving the earth piled up on either side marking its former location.

After a careful survey of the group, and having obtained free permission from Mr. G. H. Mosier to open such as were on his land, we decided to first make a thorough exploration of No. 7, a mound of symmetrical outline, and one of the largest in the row. Accordingly, we had our camp outfit hauled up from the river, and pitched our tent hard by on the site of Mound No. 6.

In outline, but for some erosion at the brow of the bluff on the north, Mound No. 7 is almost a perfect circle, with a present diameter of about eighty-five feet, and a height, from summit to floor, of just ten feet; but, as it has been cultivated over for many years, it was probably much higher originally than now, with a diameter proportionately less.

*In the report of the former expedition the number is given as twelve, but we could only make out nine at the time of this visit.

Owing to a long-continued drought, the surface earth was very dry and hard, requiring a pick to facilitate its removal, and even after penetrating the crust the digging was by no means easy; but, applying ourselves to the task, we proceeded to open a trench four feet wide by eighteen feet long, extending across the apparent center in a direction approximately north and south. The earth composing the mound is a stiff clay loam, for the most part homogeneous, but with some scattered patches of a purer clay, and a thin layer of the same, of varying thickness, which, about five feet below the surface, appeared plainly, in section, on the hard perpendicular walls of the trench at its northern end. Farther down, the earth became somewhat darker, as of loam with a less admixture of clay, until, at a depth of ten feet, we came upon a perfectly well-defined floor, consisting of a layer of light-yellow, sandy clay, about three inches thick, resting on the original subsoil of compact pure clay.

Thus far, no bones or other deposits had been found, save a mass of rotten wood, the crumbling remains of what were, apparently, decayed oak logs, which, about half way down and just north of the middle of the trench, extended across and beyond it on either side, slanting down toward the south, while just beneath them the clay stratum above mentioned dipped and disappeared.

The fact that in most of the mounds of this group decayed oak wood in considerable quantities is found, was mentioned by Mr. Pratt in his report of the previous expedition.

For convenience in throwing out the earth, about six feet of the south end of the trench was at first but partially excavated, leaving a temporary bench, and we proceeded to run transverse, arched galleries, at the level of the floor, from the excavated part. These galleries were from three to four feet wide and about four feet high, their arched shape, together with the stiffness of their walls, making this method of procedure comparatively safe. Nine galleries in all were dug, besides numerous pockets and connecting passages, laying bare about five hundred square feet of the base. In patches covering much of the floor, to the south of the apparent center of the mound, was a thin layer of a whitish ash, above which were several alternating layers of a darker ash and soft earth, of varying thickness; and just above these again, as seen plainly in section throughout the galleries to the east and south, a continuous layer of rotten wood, as of logs irregularly laid on after the mound had been built up about four feet. This log covering, where present, dipped quite regularly outward, as it would naturally do, following the curvature of the mound. Above

these lower layers, whether wood intervened or not, the superincumbent earth was very compact, there being no appearance whatever of the mound ever having been disturbed.

Such was the structure of the mound in its southern part; but in the northern end of the trench and the galleries radiating from it, neither wood nor ash was found, nor any other evidence of the agency of man (except, perhaps, the distinct clay layer above mentioned), save a continuation of the floor, scattered over which, in greater number here than elsewhere, were occasional small flint chips, raising our hopes of discovery when the spade would strike against them. Throughout the work in this mound, no shells or fragments of shell were seen, excepting the beads hereinafter mentioned, unless, indeed, a layer of what seemed an especially white ash, in contact with the decayed wood, above and below, were burned or decomposed shells instead, as suggested in the description of Mound No. 6 (Proc., Vol. I., p. 107). If of ash, as they probably were, they must have been placed there after burning, since the wood shows no trace of the action of fire. Indeed, save one or two minute bits, no charcoal was anywhere found in the mound. Not a single shard of pottery was seen, nor even a stone of any size, and only a very few pebbles, small and rough, scattered through.

Almost immediately on starting the first gallery west, about midway of the trench and two feet above its floor, we came upon a mass of human bones, consisting of two femurs, a clavicle, and several bones of the left arm, forearm, and hand, all in a heap, and with them a small piece (the only one found) of worked flint. How they came to be there, placed and dissociated as they were, we could not conjecture. There was no appearance of the earth having been disturbed above them, and their state of preservation was much the same as that of the corresponding parts of the entire skeletons afterward found.

Nothing further was discovered until we had tunneled several feet back from the trench, where, following the thin layer of ash—here continuous and quite distinct on the level floor—and just after making a turn to the south, we struck on a so-called copper "awl," standing upright and firmly embedded in the hard clay base. About two feet beyond this we came upon the first of a rich group of relics, viz: four copper "axes," so-called; two curved-base pipes—one of calcite, translucent, with cylindrical bowl, and one of catlinite, finely carved in the image of a hawk, with eyes of pearl;* a large block of mica in loose

*A similar bird pipe, with pearls for eyes, was taken from Mound No. 6 in this group by Mr. Pratt's party, in 1875. (See Proc. Dav. Acad. Nat. Sci., Vol. I., p. 108.)

flakes; another awl, and a crushed human skull (the entire skeleton being afterward found in place), from beneath which one of the axes, completely wrapped in a crumbling covering of cloth and bark impregnated with copper carbonate, was taken.

Continuing the excavation, another copper axe was found near the left shoulder of the skeleton, and a large quantity of beads, both of pearl and shell, dull and fragile, in the region of the neck and chest.

Having removed the remaining earth from the trench, another cross-gallery was now started just at its southern end, and in the western branch of this gallery we very soon came upon the body of the skeleton to which the skull before found belonged. It was the skeleton of an adult male, lying extended, face up, with the head to the north-west.

Close by the right side, and with its head on a level with the shoulder of the larger skeleton, was that of a child of perhaps ten years, its lower maxilla showing the rudimentary permanent teeth under some of the milk teeth which were still in their sockets, while the wisdom teeth had not been erupted. Just beyond the child's skeleton was found a third copper awl, and the floor of the mound here rose quite abruptly about ten inches, like the side of a basin, while it sloped considerably under the bodies toward their feet.

As the south abutment at the entrance of the last arch constructed rested directly upon the thighs and knees of the larger skeleton, these parts were, of necessity, left for the time undisturbed, and a gallery was run southward from the end of the trench, where we soon came upon the feet in place, about which and the legs were more shell beads. Below the feet from eighteen to thirty-six inches, and about two feet apart, was a row of three more copper awls, making a total of six of these pins, five of which were upright when found, piercing the floor, above which they projected one or two inches. They are from four to seven inches in length, about one-eighth of an inch through, hammered square, except at the pointed lower end, and turned abruptly over at the top, being similar to those shown in Figs. 1 and 5, Pl. VI., Vol. I., Proc. Dav. Acad. Nat. Sci. The suggestion made by one of our party, that they might have been used to pin down a covering of skins or cloth placed reverently over the bodies of the dead, seems plausible in view of their relation to the skeletons and the floor.

Beyond the feet of the bodies we dug for some distance into the side of the last gallery, till there, also, the floor began to rise, as it had at their right and, less markedly, at some distance above their heads beyond the grouped relics, forming, as it were, part of the rim of a dish

bounding our work toward the south, on whose inner slope the two bodies lay.

Deeming it useless to proceed further in this quarter, we abandoned the southern part of the mound, cutting away the supporting pillars behind us, thus completing the exposure of almost the entire floor of this section, and afterward filling in with the loose earth which had accumulated in the north half of the trench.

The floor at this end being again laid bare, we proceeded as before, tunneling under for eight or ten feet at its sides and end, finding no indications, however, of another burial — finding nothing, indeed, but a continuation of the level floor toward the bluff, which, so far as we followed it, showed no rim-like rise to the north corresponding to that on the opposite side.

As we had devoted most of our available time to this mound, and there were no indications to encourage further research, we decided to quit work here, and replaced the earth in and over the trench, leaving the contour of the mound but little disturbed.

Had the initial trench been extended a few feet further south, and carried down at once at this end, to the floor, we would have come directly upon the skeletons and the relics accompanying them; but a better insight into the structure of the mound and a fuller assurance that nothing of interest was left undiscovered, well repaid the additional toil.

In addition to the work done on Mound No. 7, we made a partial examination of No. 8, situated some two hundred feet further west, and also of a small mound about half a mile south-east of the village. No. 8 is probably the largest of its group. In the early settlement of the region it had been utilized as a building site, a large depression to the south of the center indicating where the cellar had been. Due allowance for the leveling effects of time under the circumstances of its occupancy, leaves for the mound a diameter of one hundred and forty feet and an altitude of eleven.

To the south of the center, partially in the cellar depression, and extending in a north-easterly direction, we opened a trench three and a half feet wide and sixteen feet long. In the trench, at a depth of about nine feet, we came upon the floor, which was simply a layer of yellow clay about a half inch in thickness, resting on black loam, doubtless the original surface soil. Immediately above the clay, also, was the same black loam, the interior of the mound being here moist and sodden by reason of the depressed excavation. In the trench, resting on the floor and covered by loam, we found parts of four skeletons, much

decomposed; but associated with them were no relics of any description. This absence of all deposits other than bones, together with the slight pains which had evidently been taken with the floor, gave the impression that, although the largest in the group, this mound had served for the more ordinary burials, or that perhaps the part we were at work in was simply an addition to an older mound.

With this thought we ran a tunnel eighteen feet long from the northeastern extremity of the trench in a westerly direction toward the highest part of the mound. Here, the layer of clay having disappeared, we started a tunnel due south, being encouraged to hope for greater developments in this direction by reason of a thickening of the floor. In about three feet, however, it again disappeared, and we gave up the work, regretting the want of time which prevented us from exploring other parts of this mound, for we felt that so large a structure might well contain further deposits.

In addition to these two mounds of the principal group, a short time was devoted to exploring one of a group on the other side of the village, back from the brow of the bluff, which had been partially excavated by Mr. Daniel Hindman, a young man residing in the place, some six years before. Work at that time had been suspended because of the interfering roots of a tree which he had not permission to remove, but not before a pipe and part of a skeleton had been found. This mound is about thirty feet in diameter and three feet high. We merely enlarged the old excavation, and in so doing came upon the greater part of a skeleton, and on the same level (we could trace no definite floor), about a foot to the right of the skeleton, we found two earthen vessels, one near the head and the other opposite the middle of the body. Both were turned on their sides and badly crushed, the one near the head being filled with ashes and earth. At a point about a foot above the head, the pick crushed through a large piece of mica, and a chunk of obsidian weighing two pounds was found on a level with the skeleton at, approximately, the center of the mound.

On the morning of Friday, the 30th, it being impossible to remain longer, we struck our tent, reloaded our skiff, and rowed across the Mississippi to New Boston, where, in a few hours, we were fortunate enough to obtain passage for ourselves and boat on the "Pittsburg," upward bound.

E. P. Lynch. C. E. Harrison.
H. C. Fulton. C. H. Preston.

ADDITIONAL EXPLORATIONS AT TOOLESBORO.

Read before the Academy, November 27th, 1886.

HAVING, by the courtesy of Mrs. E. H. Mallory, of Toolesboro, Louisa County, received permission to explore one of the remaining undisturbed mounds of the group, and which is situated on her land, the undersigned visited that place on the 18th of October for that purpose. We found the mound — No. 5 of that group — situated in a garden where the ground has been cultivated for many years, until the height of the mound has been reduced to an extent which cannot now be determined. Judging from the others of the same group which have not been so changed in proportions, it must probably have been from eight to ten feet high.

Securing some laborers to assist in the work, we began by opening a trench, about five by eighteen feet, near the south side of the mound, and running east and west. The soil of which it was composed was a mixed earth such as is usually met with, very hard, and containing here and there minute bits of charcoal. At the depth of four feet four inches, we came upon an evenly spread layer of quite clean yellow clay, from half an inch to an inch in thickness. This was evidently an artificial deposit placed upon the surface after removing the soil, which in that locality is very thin, and is slightly below the level of the surrounding surface of the field. We dug down below it in several places, but found only the natural, undisturbed earth.

Finding no human remains or relics thus far, we cut down another five feet in width along the north side of the excavation already mentioned. In this, about half-way down, we found a small rough chert knife or scraper. In this cut, at the bottom, at the west end, were a few human bones, not very well preserved; from which, however, we secured one skull in tolerably good condition, and the frontal bone of another of remarkably low, flat, brutal form. With these bones was the shell of a turtle, broken into many and small pieces, showing, however, that it had been sculptured to some extent, though it was in so small fragments that the design of the cuttings could not be made out. This excavation was extended farther west and south, entirely beyond all indications of remains of any kind. At the bottom of this excavation, and about at the middle of the mound, we found a very finely carved, smooth and symmetrical curved-base pipe, with plain, round

bowl, made of gray pipestone. There were no bones or other remains near it.

We next cut down another slice along the north side of the former, five or six feet wide and about twenty-five feet in length. In this we went to the clay layer at bottom without making any discoveries whatever. At the east end, however, we found that the said layer of clay stopped at a sharp line running diagonally across. Digging down into the space not covered with the clay, we found that a "grave" or excavation had been dug there to the depth of twenty inches, when we again came down to the natural, undisturbed clay. At the bottom of this, lying along the south-west side of the pit, and with the head to the north-west, was a very much decayed adult skeleton, and mixed up with the bones of the trunk were a few of the bones of a child.

In order to uncover this pit entirely, we made a still further cut northward, thus exposing, in all, some twenty-five feet square of the floor of the mound. On removing the earth entirely from this deeper burial-place, we found another skeleton lying at right angles with the first, along the north-west side of the pit, and were greatly disappointed at finding associated with the bones in this portion, which seemed to have been prepared with especial care, no relics of any kind whatever. This pit was of irregular form, measuring eight feet along the south-west side, seven feet on the north-west, and the other sides six and five feet respectively.

This mound, though nearly of the same size of the others of the same group, is remarkable for the entire absence of copper relics, beads, marine shells, pottery, mica, obsidian, galena, and flint, bone, and horn implements (except the scraper above mentioned).

Mr. G. H. Mosier and Mr. Hannibal Parsons were very kind and courteous, and both gave us full privilege to explore any mounds we might find on their property. We opened one supposed mound on the land of each, but finding no encouragement or indications of relics or of work of human hands, abandoned them.

C. E. Harrison.
W. H. Pratt.

CONTRIBUTIONS TO THE MOLLUSCA OF FLORIDA.

BY CHARLES T. SIMPSON.

Read before the Academy, December 31st, 1886.

INTRODUCTORY.

THE following pages are chiefly the result of the collections made during a four years' residence near Braidentown, on the west coast of Florida. No pretensions are made to its being a complete list, as it comprises, for the most part, only such species as were collected by the author, and those received from reliable collectors from within the limits of the State. It was my intention, while residing in Florida, to at some time publish a complete catalogue of all the species of mollusca belonging to the State, and, with that intention in view, I had planned an extensive cruise last winter down the west coast, up the Caloosahatchee to Lake Okeechobee, the South-eastern Keys, and up along the east coast of the mainland; but unforeseen circumstances compelled me to leave the State, and completely changed my plans. This fact, the lack of literature on the subject, the terrible confusion that exists in the nomenclature and synonymy of Floridan and West Indian shells, together with the fact that there are but few resident conchologists in the State, and that but little material can be obtained unless by actually collecting it, have led me to abandon the project and to substitute, instead, a catalogue of my own collections, with notes and observations made while actually in the field.

In the listing of these shells I have been particularly careful as to locality, knowing that our knowledge of geographical distribution depends wholly upon the accuracy of collectors in this direction. An excellent memory in this respect, the careful labeling of specimens, and notes taken while collecting, have rendered the statements of locality given tolerably accurate.

Where shells were found more or less throughout a wide area, I have often marked them "West Coast," meaning that they were found at many points along the west coast of the State; or, "Florida Keys," alluding to species common to the lower chain of Keys, and not to those of the western coast.

With regard to the distribution of the mollusca of Florida, my experience has given the following results:

First — On the west coast the marine shells consist of a number of Atlantic coast forms, a few species peculiar to the south-east coast of the United States, and a very large number of West Indian shells. From the vicinity of Tampa Bay to the extreme point of Cape Sable, I found but little change in the species. Such shells as Strombus pugilis, the Fulgurs, Pyrula papyracea, the Fasciolarias, Melongena corona, Natica duplicata, Oliva literata, Nassa vibex, Littorina angulifera and irrorata, and Crepidula fornicata, among the Gasteropods, and Ostrea virginica, Venus mortoni, Loripes edentula, Mactra similis, Donax variabilis, Cytherea gigantea, Cardium magnum, several species of Mytilus and Modiola, and the Pinnas seminuda and muricata, among bivalves, are characteristic of the west coast throughout the region which I have indicated. A few West Indian species become more plentiful as we go southward; thus, Cancellaria reticulata is somewhat rare in the vicinity of Tampa Bay, but is plentiful on Sannibel Island, a hundred miles south, and so on to the extreme end of the State. Tellina puniceus is very seldom found north of the Caloosahatchee River, but at Cape Sable it is abundant; Natica canrena is more abundant to the southward, etc. Still, the difference in a collection of shells made at Anna Maria Key and one from Cape Sable is hardly perceptible. But when one crosses over to the nearest of the lower range of Keys a very different shell fauna is met with. On these Keys the characteristic species are such shells as Vasum muricatum, Strombus gigas and bituberculatus, the Tritons, Ricinula nodulosa, the Purples, Marginella carnea and guttata, Ovulum gibbosum, Columbella mercatoria, the Cypræas, the Doliums, the Neritas, the violet snails, several species of Littorina, the Imperators, a number of Acmæas, the Strigillas, Mytilus exustus, the Pernas, and the like, *scarcely one of which is ever found on the west coast of the mainland at all.*

This change may be accounted for in part, no doubt, by the fact that the Keys are of coral formation and that the shores of the west coast of the mainland are mostly sandy; but I believe the Gulf Stream to be accountable for most of this. It sweeps to the southward a long way to the west of the mainland of Florida, but is crowded in close to the Tortugas and the Florida Keys, and is kept in near to these Keys on the south-eastern shore and for a long distance up the east coast of the mainland. The theory that this is the distributor of many of these tropical forms is sustained by the fact that such shells as Purpura floridana, Strombus bituberculatus, Marginella carnea, Cassis tuberosa and

cameo, the Doliums, galea and perdix, the Ianthinas, Arca incongrua, Pecten ornatus, and many others, are found along the entire eastern coast of the State, and even, in some cases, as far north as the coast of North Carolina, though not one of them, so far as I know, is found on the west coast. The molluscan fauna of the Bermudas, though these islands lie north of the northern limit of Florida, is much more like that of the lower Keys than that of the west coast.

Another point worthy of notice is that many of the Atlantic coast species appear on the west coast of the State, some of which, though abundant at Tampa Bay and northward, are not found, or are rare, at the southern extremity of the peninsula. Among the Atlantic coast species found on the western shore of the State, I may mention Urosalpinx cinerea, Eupleura caudata, Columbella avara, Natica duplicata, Crepidula glauca, fornicata, and convexa, Bittium nigrum, Littorina irrorata, Mactra lateralis, Crassatella lunulata, Macoma proxima, Ostrea virginica, etc. Some of these extend westward to the coast of Texas. I have seen a number of these in the collection of Mr. Harry A. Pilsbry, picked up by him at Galveston, and among them valves of Petricola pholadiformis, a shell which I have never found on the west coast of Florida. It is reported from that locality by Mr. Calkins, but I have seen the shells presented by that gentleman to the Davenport Academy and bearing that label, and they are only worn valves of *Pholas costata*. Whether or not these species passed into the Gulf of Mexico before the peninsula attained its present dimensions, as has been surmised, is a question I think we cannot settle until we know more of the distribution of living forms and of the fossil species of the State.

I found the Tortugas wonderfully rich in the smaller forms of the mollusca, and many species were obtained there which I think have never heretofore been credited to Florida. Sarasota Bay and vicinity and Tampa Bay were also very prolific in species. A single dredging trip of some twenty hauls, in the latter body of water, yielded about one hundred and twenty-five species, many of them never obtained elsewhere.

Second — The land shells of the State consist of a few species of wide distribution, such as Zonites indentatus, arboreus, minusculus, and fulvus, Strobila labyrinthica, several of the Pupas, Carychium exiguum, Succinea obliqua, and the like; a number that are peculiarly southern in their distribution, among which the Polygyras are numerous, both as to species and individuals, and a good many species whose metropolis is the West Indies and South America, probably brought

by the Gulf Stream. Among these may be mentioned Zonites gundlachi, Cylindrella poeyana, Bulimulus marielinus, Strophia incana, Stenogyra subula and gracilima, Liguus fasciatus, Orthalicus undatus, the two species of Macroceramus, from Cuba; Helix varians, from the Bahamas; and Bulimulus multilineatus, from South America. Glandina truncata is also a Cuban species, as well as Helix vortex and Chondropoma dentatum. Of the West Indian shells, Strophia incana, Bulimulus marielinus, the Stenogyras, Helix varians, Orthalicus undatus, the Cylindrellas, and Chondropoma dentatum seem to be confined to the lower Keys or the extreme southern portion of the peninsula; Bulimulus multilineatus and Liguus fasciatus range farther north; the two species of Macroceramus extend to Tampa Bay; and the remainder are probably found over the greater part of the State. Of course these limits may be extended by future research.

Third — The fresh-water species have but a small representation from the tropics. Planorbus tumidus is a Cuban shell; so are Ampullaria depressa and Neritina reclivata. Ancylus obscurus is West Indian, and Ampullaria caliginosa is from Mexico and Nicaragua. A number of the univalves are of northern origin, no doubt: such as Limnæa humilis, Planorbis trivolvis, Physa heterostropha, and the like. The species of Unios are all, so far as I know, confined to the waters flowing into the Atlantic and Gulf of Mexico, and many of them are probably peculiar to the State.

In the preparation of this catalogue, I have been continually under obligation to Mr. William H. Dall, of the United States National Museum, at Washington. He has identified several hundreds of the smaller and less known species, has aided me constantly with advice and valuable suggestions, and has written out the descriptions of the new species. To him my thanks are due for his patience and forbearance throughout. Mr. Dall wishes me to say that he has simply given a name to such species as have passed through his hands; that it would be impossible to tell whether these names will stand or not when the synonymy is thoroughly worked out.

I would also express my obligations to Mr. John Ford, of the Philadelphia Academy of Natural Sciences, for comparing many of my species with the type-shells in the museum, and for kindly help and encouragement; to M. C. F. Ancey, of Marseilles, France, for identifying many of the land species and fresh-water univalves; to Mr. William A. Marsh, of Aledo, Ill., and Mr. Harry A. Pilsbry, of Davenport, Iowa, for assistance in identifying the Unios.

I have no doubt that there are errors in this catalogue. It has been prepared in haste, in the odd moments of a very busy life. I have but little literature on the subject, and have never had any opportunity to examine extensive libraries or collections;—in fact, a portion of my Florida species I have not yet had time to unpack and compare. My work has been mostly done in the field. I thought it better, however, to do something than to wait for leisure and opportunities which might never come. I therefore ask the kindly consideration of all into whose hands it may fall.

OGALLALA, NEB., December 1, 1886.

CATALOGUE.

[In the following catalogue, such species as have been obtained only from other collectors are designated by an asterisk (*). All others have been collected by myself.]

Octopus vulgaris L. Washed up on Long Key.

Octopus rugosus Bosc.? Florida Keys.

Ommatostrephes? A specimen washed up on Long Key, the pen of which is referred by Mr. Dall to this genus with doubt. The animal was partly decayed when found.

Spirula peronii Lam. Florida Keys; not rare.

Hyalea trispinosa D'Orb. One shell found washed up on the lower end of Anna Maria Key.

Murex pomum Gm. West coast. Very abundant at Sannibel Island and southward.

**Murex adustus* Lam. A single fine specimen was received from Mr. Isaiah Greegor, of Jacksonville, who reports it from the east coast. Tryon gives its locality as Indian Ocean, Phillipines, and Japan; but Dall, in his catalogue of West Indian shells, reports it from Cuba, on the authority of Pfeiffer.

Murex recurvirostris Brod. Anna Maria Key, one specimen; Sannibel Island; Marco, and vicinity.

Murex brevifrons Lam. Two slightly worn specimens, found at Key West, are referred to this species.

Murex chrysostomus Gray. One young shell from Sannibel Island. I have seen a fine full-grown shell, belonging to Mr. R. C. Stuart, of Tampa, found on the west coast, which is probably this species.

Murex salleanus A. Ad. West coast; more abundant at Sannibel Island and southward.

Murex nuceus Mörch. Tampa Bay; Tortugas. A number of specimens were dredged, living, in eight fathoms of water, in Tampa Bay.

Murex intermedius C. B. Ad. Worn specimens were found at Key West. I have this shell from the Bermudas and Honduras, east coast.

Murex cellulosa Con.? Dredged in Tampa Bay. Agrees better with Conrad's description of this species than with anything else.

Muricidea hemphilli Dall. Long Key to Sannibel Island. Quite variable in sculpture and coloring. I have a bright orange-colored shell.

Muricidea floridana Con. Abundant at Tampa Bay and vicinity.

Urosalpinx cinereus Say. Occasionally found in the vicinity of Tampa Bay.

Urosalpinx cinereus Say, var. A couple of heavy-shouldered shells, with short spire, somewhat worn, were picked up on Sannibel Island. Mr. Dall supposes them to be a variety of this species.

Urosalpinx tampaensis Con. Occasionally found in Tampa Bay.

Eupleura caudata Say. Dredged in Tampa Bay.

Eupleura muriciformis Brod. Anna Maria Key. A heavy, white shell, very different from *E. caudata* as dredged by me; but Mr. Dall believes it to be the same.

Purpura hæmastoma L. Key West.

Purpura floridana Con. Florida Keys; east coast, Mr. T. L. Cunningham.

Purpura undata Lam. Florida Keys. Both this and the preceding are, no doubt, forms of the widely distributed and variable *Purpura hæmastoma.*

Purpura deltoidea Lam. Florida Keys.

Ricinula nodulosa C. B. Ad. Key West; Tortugas. Abundant.

Rhizocheilus (Coralliophila) galea Chem. Tortugas, one worn shell. Two worn shells were found in Tampa Bay, which are probably this, but are more slender and not so solid as the Tortugas specimen.

Triton tritonis L., var. *nobilis* Con. I found about thirty living specimens on the reefs at Tortugas, of an apparently stunted form, being very solid and having a heavy lip, though not over seven or eight inches in length. Capt. William Bahrt, of Braidentown, has a noble shell from Duck Key that measures fourteen inches in length.

Triton pilearis L. Tortugas. This is Calkins' *T. veliei.*

Triton chlorostomus Lam. Tortugas. One fairly good adult shell.

Triton femorale L. Four fine living shells were obtained at Key West; they are not so large or bright as shells from the West Indies.

Triton tuberosus Lam. One shell found at Tortugas.

Triton lamellosus Dkr. Key West.

Triton lanceolatus Mke. Anna Maria Key, one fine shell; worn shells were picked up at Key West.

Triton eximius Reeve. Key West; Tortugas.

Triton arachnoides Mörch. Tortugas; several worn and broken examples.

Fasciolaria tulipa L. Common and variable. A form found in sheltered bays is much duller colored and coarser than those of the open sea. A mahogany-colored form is occasionally found on the Keys.

Fasciolaria distans Lam. West coast; common. Mr. Tryon makes this a variety of *F. tulipa*. I have never found the connecting shells.

Fasciolaria gigantea Keiner. West coast, and Keys. In the vicinity of Tampa Bay, adult shells are seldom over a foot long. On the Keys, I have seen dead shells two feet in length. The largest Gasteropod in the world.

Latirus infundibulum Gm. Tortugas.

Latirus cayohuesonicus Sow. Jr. Tortugas.

Leucozonia cingulifera Lam. West coast, rare; more common on the Keys.

Melongena corona Gm. West coast, and Keys. Very common and variable. A small form, described by Sowerby in Proc. Zoöl. Soc., London, is common on the Keys and southern end of the mainland.

Melongena corona, var. *bispinosa* Phil. Abundant at Lostman's Point.

Fulgur pyrum Dillw. West coast.

Fulgur perversus L. West coast; common. The shell is ordinarily painted, when young, with brown, buff, and orange; but fades into a dirty white when full grown. I have a live shell, found at Long Key, which measures fifteen and one-half inches in length. On this island I found a beautiful, pure white variety, young shells sometimes having a few black markings on the spire. Both species are found at Galveston, on the Texas coast.

Cantharus tincta Con. West coast, rare; common on the Florida Keys.

Cantharus tincta, var. *antillarum* Dkr. Key West; Red-fish Point; Tampa Bay.

Cantharus coromandelianus Lam. Florida Keys.

Cantharus parvum Ad. Tortugas.

**Cantharus cancellaria* Con. Cedar Keys.

**Phos intricatus* Dall. Key West. Received from Mr. Wm. H. Dall.

Nassa vibex Say. West coast; common.

Nassa ambigua Mont. West coast, rare; Florida Keys, common.

Nassa ambigua, var. *consensa* Rav. Dredged; Tampa Bay.

Nassa ambigua, var. *acuta* Pult. Dredged; Tampa Bay.

**Nassa obsoleta* Say. Fernandina, Mr. Henry Hemphill; east coast, Cunningham.

Vasum muricatum Born. Little Content Key; Key West.

Voluta junonia Chem. West coast. Rarely found in good condition, it being a deep-water shell. I have a specimen, in fairly good condition, from Little Sarasota Pass.

Mitra barbadensis Gm. Key West; Tortugas reefs. Several very large and fine specimens were found at the latter locality, under coral rocks, at low tide.

Mitra hanleyi Dohrn. Tortugas.

Mitra albocincta C. B. Ad. Tortugas.

Mitra sulcata Gm. Tortugas.

Mitra floridana Dall. Tortugas.

Erato mangueriæ Gray. Tampa Bay; west coast. Rare.

Marginella carnea Storer. Key West.

Marginella guttata Dillw. Key West.

Marginella apicina Mke. West coast.

Marginella apicina, white var. Key West.

Marginella opalina Stearns. Magill's Bay.

Marginella aureocincta Stearns. One specimen was found in Sarasota Bay.

Marginella pellucida Pfr. Sarasota Bay; Key West; abundant at the Bahamas.

Marginella roscida Red. West coast. I am doubtful whether this is distinct from *apicina*.

Marginella nitida Hds. Magill's Bay. One shell was found at Key West.

Marginella paxillus Reeve. Sarasota Bay.

Marginella catenata Mont. Tortugas; abundant.

Marginella ovuliformis D'Orb. Red-fish Point; Tampa Bay.

Marginella minuta Pfr. Tampa Bay.

Marginella lachrymula Gld. Tampa Bay.

Marginella lactea Keiner. Key West; Tortugas.

Marginella pallida L. Tortugas.

Marginella nivea C. B. Ad. Tortugas.

Olivella mutica Say. West coast. Quite variable.

Olivella mutica Say, var. A small, yellowish variety, marked with zigzag, brown lines, was dredged in Tampa Bay.

Olivella mutica Say, var. *nitidula* Dillw. West coast.

Olivella nivea Gm. Sarasota Pass.

Olivella jaspidea Gm. Tortugas.

Olivella floralia Duc. West coast.

Oliva literata Lam. Very abundant throughout the west coast, on sand flats, at low tide, and extends west to Texas.

Oliva literata, var. A golden yellow variety, which is almost entirely devoid of markings, is rarely found on the west coast.

Oliva reticularis Lam. Key West.

Columbella mercatoria L. The Keys; east coast, Cunningham. One living specimen was dredged in Tampa Bay, in seven fathoms. A most variable shell in size, form, and coloring.

Columbella dysoni Reeve. Tortugas. A shell agreeing with Tryon's figure and description of this was found on Tortugas, and I have the

same from Utilla, Honduras. I have no doubt that it is a form of *C. mercatoria.*

Columbella rustica L. Magill's Bay, large and fine; mouth of Caloosahatchie River.

Columbella nitida Lam. Tortugas reefs. Abundant under rocks at low tide.

Columbella cribraria Lam. Tortugas.

Columbella lunata Say. Egmont Key; Red-fish Point; Manatee River.

Columbella pulchella Keiner. Garden Key; Tortugas.

Columbella acuta Stearns. Egmont Key.

Columbella avara Say, var. *simplicata* Stearns. Manatee River, on floating dry-docks; dredged in Tampa Bay.

Columbella obesa C. B. Ad. Red-fish Point, dead shells.

Columbella ostreicola E. A. Smith. Tampa Bay; Cedar Keys, Mr. J. B. Upson.

Columbella stearnsi Tryon. Tampa Bay.

Columbella hotessieri D'Orb. Tampa Bay. Worn shells were dredged, which are probably this species.

Engina turbinella Kiener. Tortugas reefs, under stones; Key West.

Cancellaria reticulata Dillw. West coast; more abundant at Sanibel Island and southward.

Cancellaria stimpsoni Calkins. A single shell was picked up in good condition on Cape Sable.

Terebra protexta Con. West coast, rare; dredged in Sarasota and Tampa Bays.

Terebra dislocatus Say. Abundant on sand flats at low tide.

Strombus pugilis L. Common everywhere on the west coast. A color variety has the interior of the mouth colored violet and blue.

Strombus pugilis, var. *alatus* Gm. Not a distinct variety at all. I have a suite of shells, varying from perfectly smooth forms to those with sharp spines on the shoulder, and from a uniform chestnut color throughout all the different patterns of bands and zigzag painting to pale yellow. Some of the smooth forms are a uniform chestnut color. I have a tuberculate variety with a brilliant light orange aperture. All these forms are found from high tide to several fathoms' depth.

Strombus bituberculatus Lam. Florida Keys; east coast.

Strombus gigas L. Florida Keys.

Strombus costatus Gm. Florida Keys; rare. I have a weathered shell which I found on Passage Key, at the mouth of Tampa Bay, and Mr. Charles More has one, in good condition, which he found on Egmont Key, while residing there as light keeper. I have a young shell which is probably this, which Mr. P. W. Reasoner found at Little Sarasota Pass, that is of a bright crimson color. I have seen shells of this species that were collected near St. Augustine.

Cypræa exanthema L. Tortugas reefs; Key West.

Cypræa cervus L. Tortugas reefs; young. I have a fine pair which are almost black, from Key West. One very large dead shell was found at Stump Pass, by Mr. James Mann.

Cypræa spurca L. Tortugas reefs; living.

Cypræa cinerea Gm. Several dead shells and one very fine living specimen were found at Tortugas reefs.

Cypræa (Trivia) pediculus L. Anna Maria Key; Florida Keys.

Cypræa (Trivia) quadripunctata Gray. Tortugas; very plentiful.

Cypræa (Trivia) nivea Gray. Tortugas; one shell.

Ovulum gibbosum L. Key West.

Ovulum acicularis Lam. Tortugas.

**Ovulum uniplicata* Sowb. R. C. Stuart, found on the Florida Keys.

Cassis cameo Stimpson. Tortugas; rare. This fine species, once abundant at the above locality, is now seldom found, and I was told that a specimen had not been obtained there, in good condition, for more than a year. I have seen shells from the Tortugas that would not go into an ordinary water-bucket. I found a nearly entire fresh shell on the upper end of Anna Maria Key, in the spring of 1885.

Cassis sulcosa Brug. West coast.

Cassis sulcosa, var. *inflata* Shaw. Florida Keys.

Oniscia oniscus L. Key West; Tortugas.

Dolium galea L. Marquesas Keys, young; Key West.

Dolium perdix L. Tortugas; young.

Pyrula papyracea Say. West coast; abundant.

Pleurotoma zebra Lam. Key West.

Pleurotoma solida C. B. Ad. Tortugas; young.

Pleurotoma tayloriana Reeve. Sannibel Island.

Pleurotoma gibbosa Born. Anna Maria Key; one slightly worn shell.

Pleurotoma eritima Bush. Tortugas.

Pleurotoma atrostyla Dall. Tortugas.

Pleurotoma albinodata Reeve. Tortugas.

Pleurotoma cerinella Dall. Tortugas.

Pleurotoma limonitella Dall. Tortugas; Sarasota Bay.

Pleurotoma ostrearum Stearns. Tortugas.

Pleurotoma ostrearum Stearns, color var. Tortugas.

Pleurotoma biconica Ad. Tortugas.

Pleurotoma biconica Ad., var. Tortugas.

Pleurotoma caribbea D'Orb. Tortugas.

Pleurotoma (Mangilia?) Simpsoni, n. s.

The following is Mr. Dall's description of this little shell:

"Shell polished, shining, with (including the nucleus) six and a half whorls; nucleus madder-brown, smooth, rather large, blunt, with one and a half turns; remainder transversely ribbed with 8–10 smooth, rounded, nearly straight, stout ribs, extending from suture to suture, which begin with the end of the nuclear part, and fail at the last third of the last whorl, which is marked only by silky fine incremental striæ; the spaces between the ribs are equal to or somewhat less than the ribs in width; longitudinal sculpture none, or only occasional extremely faint microscopic lines; whorls not inflated; color, rosy pellucid white, banded in front of the suture with rosy brown, fainter on the ribs, and, in the specimen described, extending forward nearly to the periphery of the earlier whorls; the base of the last whorl similarly tinged; the last somewhat varicose rib and the outer thickened lip whitish; aperture and canal very short and wide, and notch deep and large, rounded, leaving no fasciole, the outer lip lightly thickened, arched forward, a slight callus on the columella; interior not lirate in the specimen described.

"Lon. 5.75 mm.; last whorl equal to half the total length; maximum diameter of shell, 2.1 mm.

"Two specimens of this extremely pretty little shell were obtained at Tampa Bay by Mr. Simpson. It differs from any known form from that region heretofore, and in the form of its aperture and notch recalls some of the west coast Drillias, but, owing to the absence of a fasciole in front of the suture, can hardly be referred to that section of the Pleurotomidæ. One specimen is in the collection of the National Museum, No. 61,040."

The only two specimens obtained of this species were dredged in about five fathoms.

Pleurotoma monilifera Sby. Tortugas.

Pleurotoma auberiana D'Orb.? Tortugas.

Pleurotoma nigerrima Dall. Tortugas.

Pleurotoma thea Dall. Sarasota Bay.

Pleurotoma fuscescens Gray. Sannibel Island.

Pleurotoma leucocyma Dall. Key West.

Pleurotoma flavescens Reeve. Tortugas.

Pleurotoma quadrata Reeve. Tortugas.

Mangilia stellata Stearns. Long Key.

Mangilia balteata Reeve. Tortugas.

Mangilia balteata, var. Tortugas.

**Clathurella jewettii* C. B. Ad. Cedar Keys, Hemphill.

**Clathurella jewettii* Stearns. Cedar Keys, Hemphill.

The Pleurotomidæ are in great confusion, and but little is accurately known concerning the species. I have used the generic name Pleurotoma for the species sometimes classed under the generic name of Drillia.

Conus floridanus Gabb. Cape Sable and northward.

Conus pcali Green? Shells collected at Long Key seem to agree tolerably well with description and figures of the above, but are larger than the dimensions given for that species.

Conus proteus Hwass. West coast. Often washed on shore, but generally worn. Probably a deep-water species.

Conus mus Hwass. A number of very fine living shells were collected on the Tortugas reefs at low water.

Conus pygmæus Reeve. West coast. Nearly jet black shells, with white squarish spots, were found in Magill's Bay. Further south, the shell is often whitish, with yellow or brown spots, and grooved throughout the entire body-whorl. I have the same shell collected on the east coast of Honduras, which is very dark and covered with pustules. I also have it from Panama.

Conus cardinalis Hwass. A single slightly worn shell was found at the Tortugas which seems to be this species.

Conus magellanicus Hwass. Tortugas. Worn shells were found at the above locality which appear to be this. The species is found at the Bahamas.

Natica pusilla Say. Young living specimens were dredged in Tampa and Terraciea Bays.

Natica duplicata Say. Abundant on west coast, being found from the open sea up to nearly fresh water in rivers, and quite variable. There is a flattened form found in the open sea which approaches *N. josephinæ* in shape.

Natica canrena L. West coast; more abundant southward.

Natica uberiana D'Orb. Tortugas; Key West; Florida Keys.

Natica mamillaris Lam. Tortugas; one worn shell.

Natica marochiensis Gm., var. *livida* Pfr. Marco; one fine shell. Occasionally found on the south-west coast.

Sigaretus perspectivus Say. West coast, on sand flats at low tide.

Sigaretus maculatus Say. Long Key; one shell in fairly good condition.

Lamellaria pellucida Verrill. Long Key; one shell.

Calyptræa candeana D'Orb. West coast; Long Key. One living specimen and an abundance of dead shells were dredged in Tampa Bay.

Cochliolepis parasiticus Stimpson. Passage Key; dredged in Tampa Bay. A few shells, all dead.

Crepidula fornicata Say. One of the most abundant shells in the vicinity of Tampa Bay.

Crepidula glauca Say. Mr. Tryon makes a species of this, but I have no doubt that it is a variety of the very variable *C. fornicata.*

Crepidula convexa Say. I have shells from Tampa Bay and vicinity that agree perfectly with figures and description of this species, as well as with shells from the New England coast. I have often found it

growing on *Modulus floridanus*. I believe it to be a variety of *C. fornicata*.

Crepidula plana Say. Common on the interior of the *Fulgurs* and other dead shells.

Crepidula aculeata Gm. West coast and Keys. Quite variable; generally found beach worn.

Capulus intortus Lam. Key West.

Capulus subrufus Lam. Tortugas.

Mitrularia equestris L. Tortugas.

Mitrularia equestris, var. *tortilis* Reeve. Key West.

**Xenophora conchyliophora* Born. South-east Keys; two living shells were received from William Bahrt.

Vermetus nigricans Dall. Sarasota Bay and other localities on the west coast, forming solid reefs between tides. In the crevices among these reefs numbers of *Mytilus exustus* and *cubitus*, and the various species of *Lithodomus* find a home.

Vermetus conicus Dillw. Egmont and Anna Maria Keys.

Vermetus lumbricalis L., var. *spiratus* Phil. Common on the west coast.

Vermetus lumbricalis L., var. *bicarinatus* Mörch. West coast; Cape Sable.

Vermetus lumbricalis L., var. *radicula* Stimp. West coast; common.

Vermetus retifera Mörch. Tortugas. A peculiar form, having the tube flattened and closely coiled, growing on corals and the piling of an old wharf, and having the apertural portion elevated. Mr. Tryon considered it a variety of *V. conicus* Dillw., but it seems to me quite distinct.

Vermetus annulatus Daudin. Tortugas. Partly imbedded in shells of *Chama macrophylla*.

Vermetus annulatus Daudin, var. *irregularis* D'Orb. Tortugas. On shells and corals, growing in dense clusters. This agrees in color and in being irregularly contorted, and transversely lamellated, with the description of this variety, but differs from it, and from the description of the subgenus in not being imbedded, and in growing in dense clusters. It is a *Spiroglyphus*, as the operculum is convex externally, with concentric laminæ, and concave internally, with a central mamilla and narrowly elevated margin.

Vermetus decussatus Gm. Egmont Key.

Vermetus nebulosus Dillw.? Tortugas. Attached to shells. On account of the irregular growth of these shells, and the fact that specimens with the opercula are seldom obtained, they are very difficult to accurately identify, and a good deal of confusion exists concerning the species. Many of them closely resemble the shells of *Serpula*, an annelid genus; they differ from the *Serpula* in having a spiral, nuclear shell, and usually internal *lamellæ* or *septa*.

Scalaria tenuis Sby. Tortugas.

Scalaria angulata Say. Tortugas; west coast

Scalaria humphreysii Keiner. Tortugas.

Scalaria eburnea Pot. and Mich. Tortugas.

Scalaria krebsii Mörch. Tortugas.

Scalaria candeana D'Orb. Tortugas.

Scalaria coronata Lam. Anna Maria Key.

Scalaria fragilis Hanley. Key West.

Scalaria hotessieriana D'Orb. Tortugas.

Scalaria blandi Mörch. Tortugas.

Ianthina fragilis Lam. Florida Keys; Key West. Has been picked up on Egmont Key by Mr. Charles Moore.

Ianthina globosa Swain. Key West. On a certain Sunday morning, while at Key West, I found the beach strewed with millions of *Ianthina fragilis* and *globosa*, the former being most abundant. Thousands of these shells contained the animals in a perfectly fresh state, and were no doubt living when thrown up the night before. There had been no storm, nor even a change of wind, and though I had searched the same beach the evening before, I had not found an example of either species. It seems as if a vast school of these animals, carried by some current, had been landed bodily on the rocky beach.

Cæcum sp. ind. Tortugas.

Cæcum pulchellum Stimp. Tortugas.

Cæcum floridanum Stimp.? Anna Maria Key.

Eulima conoidea Kurtz and Stimp. Dredged in Tampa Bay.

**Eulima psila* Wat. Obtained of Mr. Isaiah Greegor, and said to come from the east coast of Florida.

Niso aeglees Bush. Tampa Bay; dredged.

Turbonilla interrupta Tott. Tampa Bay; dredged.

Turbonilla areolata Verrill? Tampa Bay.

Turbonilla gracilis Dek. Tampa Bay.

Odostomia granatina Dall. Dredged in Tampa Bay.

Odostomia impressa Say. Cedar Keys; J. B. Upson, Tampa Bay.

Oscilla nivea Mörch. Tortugas.

Pyramidella dolobrata Lam. Little Sarasota Pass. A single fresh shell was found at the above locality. I found it abundantly fossil in the hammocks south of Manatee, in company with *Bulla striata*, the latter now found only rarely living on the Florida Keys. With these fossils were associated a great majority of the species living to-day on the adjoining coast. I believe that *Pyramidella dolobrata* has not before been reported from Florida, though it is abundant in the Antilles.

Obeliscus crenulatus Holmes. Dredged in Tampa Bay.

Obeliscus candidus Mörch. Dredged with the typical *tessellatus*.

Littorina angulifera Lam. Abundant on the west coast and Keys to Honduras and throughout the West Indies, Bahamas, and Bermudas, often climbing twenty-five feet up mangrove trees. Exceedingly variable in size and coloring. The finest specimens were found at Marco.

Littorina irrorata Say. Abundant in localities only rarely covered by high tide.

Littorina lineata D'Orb. Florida Keys; a very large, heavy, inflated form was found at Key West.

Littorina zigzag Chem. Key West; Tortugas. Quite variable; some shells nearly jet black and smooth, others with rounded whorls approach very close to *L. lineata*, with which it probably connects.

Littorina guttata Phil. One shell found at the Tortugas, and another at Utilla, Honduras. Mr. Dall identifies them as his species.

Echinella nodulosa Pfr. Florida Keys.

Tectarius muricatus Lam. Florida Keys.

Modulus floridanus Con. West coast.

Modulus lenticularis Chem. Common on the Keys; west coast, rare.

Modulus modulus L. Tortugas.

Planaxis nucleus Wood. Tortugas.

Planaxis lineatus Da Costa. Tortugas.

Litiopa bombyx Kiener. Washed up on Tortugas; very abundant on floating seaweed in the Caribbean Sea.

Alaba tervaricosa Ad. Tortugas.

Cerithium atratum Born. West coast; abundant. East coast; received from Cunningham.

Cerithium eburneum Brug. Florida Keys. Abundant and variable.

Cerithium algicola C. B. Ad. Florida Keys. I think this is merely a form of the preceding.

Cerithium semi-ferrugineum Lam. The Keys.

Cerithium literatum Born. The Keys. Quite variable in form, coloring, and sculpture. Some of the lighter colored forms are very nodulous; others are nearly smooth.

Cerithium ferrugineum Say. Abundant on the Keys; rarely found by me on the west coast. Much confusion exists concerning this shell. *Pyrazus minimus* Gm., is often mistaken for this species, and its so-called variety *versicolor* of C. B. Adams, which it somewhat resembles in size, form, and sculpture. *C. ferrugineum* is a solider shell, the aperture is smaller and is lirate within, the nodules are more distinct, and, upon the whole, it is a rougher shell. In *Pyrazus minimus* the nodules are pinched up into longitudinal plications, which become evanescent on the lower part of the whorls. I consider the variety *versicolor* C. B. Ad., of *Cerithium ferrugineum*, of no value. Mr. Tryon separates *C. rissoidaeum* Sowb., and states in the manual that it is smaller, always white or yellowish white, and that the sculpture is slightly dif-

ferent. My extensive suit of these shells from Tortugas does not show any distinction even as a variety, as the variation is from the most slender forms to those almost pupoidal, and with every shade of color from dark brown, through various patterns of painting, to pure white. Some of these shells are not over 6 mm. in length. *C. eriense* Val. is a synonym of *ferrugineum*.

Cerithium muscarum Say. A most beautiful and abundant form in Florida. A small, very delicate variety, with chestnut-colored punctations, is found on the Keys; and I also have it from the Bermudas and Honduras, but it connects with the type.

Cerithium guiniacum Phil.? A broken and slightly worn shell was picked up at the Tortugas which agrees well with this species, and is certainly like nothing else that I have seen. I have another worn specimen of the same from Utilla, Honduras.

Bittium varium Pfr. Abundant from New York to Florida, and varying from a dirty white to chocolate, with light colored varices.

Cerithiopsis tuberculâris Mont. Tortugas. A single fresh shell, the var. *acicula* Brus., perhaps, having a broad whitish band above the suture.

Cerithiopsis greenii C. B. Ad. Tortugas.

Cerithiopsis punctatum L. Tortugas; Tampa Bay. Better known as *C. emersoni* C. B. Ad.

Cerithiopsis flavum C. B. Ad. Two slightly worn shells were found at the Tortugas.

Cerithiopsis pulchellum C. B. Ad. Tortugas.

Cerithiopsis kobelti Dall. Tortugas.

Seila terebrale C. B. Ad. Common on the West coast and Keys; Cedar Keys, from Mr. Hinkley.

Potamides scalariformis Say. Abundant throughout the West coast and Keys.

Potamides iostoma Pfr. Tampa and Sarasota Bays. Narrower than *P. scalariformis*, and at once distinguished by having varices.

Potamides tenuis Pfr. Tampa and Sarasota Bays.

Potamides costata Da Costa. One shell was found in Tampa Bay.

Potamides turrita Stearns. Shaw's point; three shells. Occasionally found elsewhere. Shells received from Cedar Keys, from Mr. Hinkley, and labeled *P. tenuis* Pfr. by Mr. Dall, I think are the same as this.

Pyrazus minimus Gm. One of the most abundant and variable shells of the west coast of Florida. Specimens vary from ashy white to almost jet black, and are often chestnut, chocolate, or even reddish. Many are beautifully variegated with spiral bands of white, chocolate, brown, and yellowish. The best distinguishing character is the slightly pinched up nodulous plications on the upper part of the whorls, but they are not always so marked, as I have specimens which are nearly smooth. It is *Lampanella septemstriata* Say., *L. nigrescens* Menke,

and *L. peloritana* Cantr. I have shells with the latter name said to be from the Mediterranean.

Triforis decoratus C. B. Ad. Tortugas; Tampa Bay.

Triforis nigrocinctus C. B. Ad. Tortugas; Tampa Bay.

Triforis turris-thomae Chem. Tortugas.

Triforis intermedius C. B. Ad. Tortugas.

Triforis ornatus Desh. Tortugas.

Triforis variegatus A. Ad. Tortugas.

**Goniobasis papillosa* Anth. Holmes' Creek, West Florida. Mrs. George Andrews. Dead shells of this species were received from Mr. S. L. Cunningham, from Sumpter County.

Skenea sulcata Bush. Tortugas; very large.

Rissoina pulchra C. B. Ad. Tortugas.

Rissoina striosa C. B. Ad. Tortugas.

Rissoina cancellata Phil. Tortugas.

Rissoina reticulata Sby. West coast; probably Tampa Bay. The label containing locality of this species was lost.

Bythinella monroensis Frau. Ware's Creek; Pine Level.

Bythinia tentaculata Drap. Key West. These shells were found near a salt pond, dead, and slightly weathered, and may have been brought in ballast. I submitted them to Mr. Ancey, who identified them as above. I have the same shell, taken alive, from New York, where it has been introduced from Europe.

Hydrobia wetherbyi Dall. Pine Level, Manatee County.

Amnicola floridana Frau. Hillsborough River. Abundant on *Pistia spathulata.*

**Gillia altilis* Lea. Sumpter County. T. L. Cunningham.

**Vivipara georgiana* Lea. Beauclerc, Florida. F. C. Sawyer.

**Vivipara subpurpurea* —. Sumpter County. T. L. Cunningham.

Vivipara waltoni Tryon? Key West. Dead shells were found with *Bythinia tentaculata* at the above locality, and were identified, with doubt, by Mr. Ancey.

**Campeloma floridense* Call. Orange County. T. L. Cunningham.

**Campeloma lima* Anth.? A shell was obtained from Mr. R. C. Stuart, marked Florida, which seems to agree well with Dall's figure and description of the above species, only that it is lighter in color.

**Ampullaria depressa* Say. Sumpter and Volusia Counties, Cunningham; Orange County, Pilsbry.

Ampullaria caliginosa Reeve. Manatee County near Braiden Creek, one worn shell; Royal Palm Hammock, several hundred shells; Miami region; Cedar Keys. These agree in most respects with Dall's description in Hemphill's Shells. I have shells of *A. depressa* which are malleated, and have as large an umbilicus as *A. caliginosa.* Some shells of the latter species have a brownish operculum, and are not

marked with salmon. However, the shells of *A. caliginosa*, so far as I have seen, are generally heavier, the peristome is much thicker, and the whorls more globose than *A. depressa*. I have a lot of the latter from Havana, Cuba, which in form approach more nearly to *caliginosa* than my Florida specimens.

Truncatella pulchella Pfr. Tampa and Magill's Bays; East Florida, Cunningham.

Truncatella caribæensis Sby. Tampa Bay; Manatee River.

Truncatella bilabiata Pfr. Evans' plantation on Lost Man's River; Key West; abundant at Utilla Island, Honduras.

Truncatella subcylindrica Gray. Manatee River; Magill's Bay.

Chondropoma dentatum Say. Key West; Evans' plantation.

Helicina chrysocheila Binn. Sumpter and Volusia Counties, Cunningham. I have one or two specimens of this found at Cedar Hammock in Manatee County.

Helicina orbiculata Say. Key West; Manatee County, several localities; Evans' plantation. At the latter place, just on the borders of the everglades, a short distance above Cape Sable, I found this shell in great numbers, and varying greatly in color, ranging from pure white, cream color, and yellow, to red and purple, ashy blue, green, and beautifully variegated. Most of these were found living on the ground about rotting logs, but quite a number were taken alive on the trunks of cabbage and royal palms, in some cases as much as ten feet from the ground. This is the only instance in which I found any of the *operculated* land shells of Florida on trees. *Helicina dysoni*, a closely related species, was generally found on the under side of the leaves of *Thrynax radiata* at Utilla.

Helicina subglobosa Poey. Cedar Keys, Mr. Henry Hemphill. A few shells were found at Shaw's Point, at the mouth of the Manatee River.

Nerita versicolor Lam. Florida Keys.

Nerita tessellata Gm. Florida Keys.

Nerita peloronta Lam. Florida Keys.

Neritina reclivata Say. Ware's Creek; streams north of the Manatee River; Tampa. Generally badly eroded. Fresh and brackish water.

Neritina reclivata, var. *palmæ* Dall. Manatee River; one shell.

Neritina pupa L. Tortugas, one shell; occasionally found here in abundance.

**Neritina virginea* L. Florida Keys, William Bahrt. A large dark form.

Neritina viridis L. Tortugas. Several worn shells.

Liotia muricata Reeve. Tortugas.

Liotia cruentata Megerle. Tortugas Reefs, under stones at low water.

**Liotia tricarinata* Stearns. Tampa, Stearns.

Turbo castaneus Lam. West coast. Occasionally thrown up in great numbers.

Turbo crenulatus Gm.? Received from Pensacola.

Imperator caelatus Chem. A large worn shell was found at Key West; one young shell was picked up at the Tortugas.

Imperator caelatus, var. *Cubensis* Phil. Tortugas; Key West.

Imperator brevispina Lam. Florida Keys.

Imperator tuber L. Tortugas; one young shell, somewhat worn.

Imperator longispina Lam. Tortugas.

Imperator americana Gm. Key West. Worn shells; Content Key; Sand Key; Tortugas; very abundant at low tide, living on dead coral.

Livona pica Gm. Little Content Key; Key West. Dead shells.

Trochus indusii Chem. Florida Keys.

Trochus fasciatus L. Tortugas. Abundant; very variable. A large form was found at Key West.

Trochus tampaensis Con. West coast. I found this shell on the mainland of Honduras, east coast.

Margarita riisii Dunker. Tortugas.

Stomatella picta D'Orb. Tortugas.

Fissurella fascicularis Lam. Key West.

Fissurella fasciata Pfr. Tortugas.

Fissurella cancellata Sby. Tortugas.

Fissurella listeri D'Orb. Key West; Tortugas.

Fissurella gemmulata Reeve. Tortugas. A large number of shells of this lovely little species were collected at Garden Key.

Fissurella alternata Say. West coast; not common. Found more abundantly at "The Rocks," Little Sarasota Pass, than elsewhere; East coast, Cunningham.

Fissurella nodosa Born. Tortugas.

Fissurella barbadensis Gm. Tortugas; Key West. A few shells of the rough variety.

Fissurella barbadensis. Smooth variety. One worn shell at Garden Key; Tortugas.

Rimula frenulata Dall. Tortugas. One shell was broken in sending to Mr. Dall for identification. He has since received this species from Turtle Harbor, Florida, and also from North Carolina.

Emarginula tumida Sby. Tortugas.

Emarginula octoradiata Gm. Tortugas.

Emarginula octoradiata, form *clausa* D'Orb. Tortugas; Key West.

Emarginula octoradiata, var. *depressa* Blainv. Tortugas.

Emarginula emarginata Blainv. Tortugas.

Acmæa puncturata Lam. Tortugas; Key West.

Acmæa pustula Helb. Tortugas; Key West.

Acmæa notata Lam. Tortugas. Key West.

Acmæa melanoleuca Gm. Tortugas.

Acmæa melanoleuca. White variety. Tortugas.

Acmæa pulcherrima Raws. Tortugas.

Acmæa pulcherrima, var. Tortugas. This beautiful little shell and the variety were washed ashore on Garden Key.

Chiton apiculatus Say. Dredged in Tampa Bay. Other localities on the west coast. Generally found adhering to dead shells.

Chiton multicostatus C. B. Ad. Key West, on coral rocks.

Chiton astriger Knorr. Tortugas, on coral rocks on the reefs.

Chiton spiculosus Knorr. Tampa Bay; west coast.

**Chiton pectinatus* Sowb. Key West; low tide, Dr. William Rush.

Tornatina candei D'Orb. Tampa Bay.

Actæon delicatus Dall. Red-fish Point.

Actæon floridanus Con. Red-fish Point.

Actæon punctostriatus Adams. Tampa Bay.

Bulla occidentalis Ad. West coast and Keys. An abundant and most variable shell. At one time, after a storm, I found thousands of living examples washed ashore on the north beach of Egmont Key.

**Bulla undata* Brug. Several fine shells were received of William Bahrt, collected by him on the South-east Keys.

Bulla striata Brug. Tortugas. A few dead shells. Abundant at Havana and Utilla Islands; Honduras. Found in great quantities, fossil, in the hammocks south of the Manatee River, where many shells retain their coloring.

Haminea succinea Con. Salt Pond, Terraciea Island, very large specimens; Egmont Key; Long Key.

Haminea virescens Sby. West coast; Salt Ponds, Terraciea Island; mouth of Manatee River, etc. At one time, while collecting at Long Key during a very low tide, I found thousands of this species crawling about in a sheltered locality between tides, on a shelly beach, among a species of broad-leaved grass. They were all young.

Haminea antillarum D'Orb. Manatee River; Terraciea Island. A beautiful and delicate shell.

Hydatina physis L. West coast; rare. I found broken shells at "The Rocks," Little Sarasota Pass, and at a few other localities. I have a shell from Mr. R. C. Stuart, collected on the west coast, locality unknown.

Utriculus canaliculatus Say. Mouth of Manatee River; Terraciea Island.

Aplysia protea Rang? Marco. Abundant in the passes among the Ten Thousand Islands. Occasionally seen in Sarasota Bay.

Glandina truncata Gm. West coast and Keys; very variable. Sumpter County, Cunningham.

Glandina truncata, var. *parallela* W. G. B. Undoubtedly only a form of *G. truncata*. The heavy shell with cylindrical or compressed body whorl, I found mostly on shell mounds, where they seem to live on and around *Opuntia polyantha;* while the typical *truncata* was most abundant around ponds in pine woods. A small, red form was obtained at Evans' plantation, and another, something like *G. texasiana* in form, but shorter and more solid, and of a light salmon color, was found on Cape Sable.

Zonites arboreus Say. Rather plentiful in hammocks in and around decaying logs; Sumpter County, Cunningham.

Zonites indentatus Say. Usually found with *Z. arboreus*; Sumpter County, Cunningham.

Zonites gundlachi Pfr. Evans' plantation; Manatee County.

Zonites fulvus Drap. Evans' plantation; Monroe County; Cedar Hammock; and hammock near the village of Manatee, with *Z. gundlachi.*

Zonites minusculus Binn. Manatee County, several localities; Evans' plantation.

**Zonites suppressus* Say. Gainesville, J. B. Upson; Fernandina, Henry Hemphill. I have a shell from Terraciea Island, which I think is the same.

Tebennophorus carolinensis Bosc. Terraciea Island, in heavy hammock.

Microphysa vortex Pfr. Goodland Point; Evans' plantation. Tolerably abundant in both localities.

Helix (Polygyra) auriculata Say. One of the most common land shells of Manatee County. Abounding around ponds in pine and hammock woods. The shell varies a good deal in size.

Helix (Polygyra) uvulifera Shutt. Found abundantly in a hammock south of the Manatee River.

**Helix (Polygyra) postelliana* Bld. Callahan, J. B. Upson.

**Helix (Polygyra) auriformis* Bld. Volusia County, Cunningham.

Helix (Polygyra) cereolus Mühl. Anna Maria, Passage, Mullet and Long Keys.

Helix (Polygyra) carpenteriana Bld. A very common form on the mainland near the sea. On Rabbit Key, near Cape Romaine, I found this species under *Agave rigida*, in such quantities that it could be scraped up in handfuls, and nearly all living.

Helix (Polygyra) septemvolva Say. Keys along the mouth of Tampa Bay. There is no doubt now that the above three are merely forms of one species, which Mr. Dall unites under the oldest name, *Helix cereolus* Mühl. In the summer of 1884, I found on Mullet Key a great number of living specimens of the above species, varying through every range of size and number of whorls from the smallest *carpenteriana* to the largest *septemvolva* or *cereolus*, and having an

equal diversity of coloring. There were some smooth shells, others with rib-like striæ, as well as great variation in the height of spire and the carination of the outer whorl. In fact, it seemed as though all the forms I had hitherto met with of this protean species, were here mixed together, as if to prove at a glance that they were merely forms of one and the same thing.

Helix (Polygyra) febigeri Bld. Sumpter County, Cunningham; Key West. I cannot in any way distinguish these from shells with the same name from New Orleans. Those received from Mr. Cunningham were labelled *Polygyra febigeri.* Undoubtedly a form of *H. cereolus.*

Helix (Polygyra) pustula Fer. Shaw's Point, at the mouth of the Manatee River; Cedar Hammock, and occasionally other localities in Manatee County; Gainesville, J. B. Upson.

**Helix (Polygyra) pustuloides* Bld. Cedar Keys, J. B. Upson.

**Helix* (*Polygyra*) *avara* Say. Sumpter County, Cunningham; Jacksonville, Hemphill.

**Helix* (*Triodopsis*) *hopetonensis* Shutt. Jacksonville, J. B. Upson; Cedar Keys, Hemphill.

Helix (*Mesodon*) *major.* A single fine shell of this species was seen in the possession of Mr. R. C. Stuart, who collected it while on a cruise along the West coast.

Helix (*Mesodon*) *jejuna* Say. Point Pinellas on shell mound, abundant but dead; Terraciea Island; banks of Ware's Creek; Braidentown; and Fogartyville. The only mollusk ever found in high dry pine woods in Florida. I have seen it crawling on barren dry sand near Braidentown, and around my dwelling, and along the road in Fogartyville.

Helix (*Mesodon*) *mobiliana* Binn. This form of *jejuna* was found, associated with the typical shell.

Helix (*Strobila*) *hubbardi* Brown. Cedar Hammock, Manatee County; small and very light colored. A larger dark brown shell was found at Goodland Point, and Evans' plantation.

Helix (*Strobila*) *labyrinthica* Say. Cedar Hammock; hammock south of Manatee River, rather plentiful. Fossil also at the latter locality.

Helix (*Hemitrochus*) *varians* Menke. Key West.

Helicodiscus lineata Say. Terraciea Island; Pine Level, in a swamp in moss about the roots of trees.

Bulimulus multilineatus Say. Key West; dead shells, but many of them large and in good condition. At Pine Key (Lower Keys) about one hundred and twenty fine large specimens were collected from trees and shrubs, at a few feet of elevation from the ground. All were attached (they were collected in May) by a thick epiphragm. Torch Key, a few dead shells. Mr. John Brown, of the U. S. Coast Survey Schooner "Quick," brought me about sixty living specimens from Caxonibas, of what seems to be a smaller, darker variety than those I collected.

Bulimulus dormani W. G. B. Several hundred dead shells were found in the heavy hammock north of the Manatee River, in the winter of 1884. The following summer I found a number of the same species, alive, at the above locality, crawling on the under side of the leaves of the cabbage palms. The animal is a beautiful porcelain color. Occasionally found in other localities in Manatee County. I have the same shell from Volusia County, from Mr. Cunningham.

Orthalicus undatus Brug. Key West. Dead shells of the typical form were found near the city.

Orthalicus undatus, var. Cape Sable. The variety figured in Binney's Manual of American Land Shells, p. 440, was found abundantly on trees at Cape Sable. Many of these were so firmly attached by the epiphragm that it was impossible to remove them without cutting the bark from under them. Several were broken in attempting to twist them off.

Liguus fasciatus Mull. Goodland Point; abundant. At this locality a water bucketfull of this species was collected from the trees in a few hours, in one of the most terribly tangled tropical thickets I ever saw. They seemed to appear in greatest numbers during cloudy and misty weather. On one such morning I found the trees and shrubs full of them, but the mosquitoes and sand-flies, which take advantage of such weather, were so intolerable that I was compelled to retreat. The variety found here was either pure white, or slightly marked with greenish or brown lines on the body whorl. At Cape Sable some of the shells were marked with a broad spiral band of brilliant orange, and on one shell the band was bright green. At Rabbit Key the variety was found, having a wide brown band, and at Pine Key a very large form, greatly elongated, with flattened whorls, and beautifully marked with brown, green, blue, and purple, on a yellow ground, one of the loveliest land shells I have ever seen. All these forms had the columella and tip of the spire stained with pink. At Pine Key one living shell was found, of a chalky-white throughout, and having a single very narrow olive line on the body and next whorl, the columella being as distinctly truncated as most of the African *Achatinas*. *Liguus fasciatus* is reported to me on good authority from as far north as Sanibel Island, at the mouth of the Caloosahatchie.

Stenogyra gracillima Pfr. Key West. Found abundantly, mostly dead, near high tide mark.

Stenogyra subula Pfr. Key West; about twenty living examples.

Macroceramus pontificus Gld. Point Pinallis, on shell mound with *Helix jejuna;* Shaw's Point.

Macroceramus gossei Pfr. Key West; Evans' plantation.

Pupa fallax Say. Point Pinallis; Long Key; Anna Maria and Passage Keys.

Pupa rupicola Say. On shell mounds and in heavy hammocks; abundant.

Pupa armifera Say. Low hammock south of the Manatee River.

Pupa contracta Say. With *P. armifera*, Manatee County; not rare.

Pupa pentodon Say. Old fields south of Manatee River; Magill's Mound, on Terraciea Island.

Pupa floridana Dall. Cedar Hammock, south of Manatee River.

Strophia incana Binn. Key West, abundant but mostly dead, on lands occasionally overflowed by high tide; Torch Key; Pine Key (Lower Keys). At the latter place thousands of living shells were found, many on the ground among leaves and at the roots of trees, and others on bushes with *Bulimulus multilineatus*, though not often climbing over four or five feet high.

Succinea luteola Gld. Ponds near Braidentown. Very abundant.

**Succinea effusa* Shutt. Sumpter County, Cunningham.

Succinea campestris Say. Key West; keys in the vicinity of Tampa Bay. Abundant.

Succinea obliqua Say. One fine shell from a pond near Fogartyville, Manatee County, is identified as this by Mr. Dall, with certainty. I believe this is the first time it has been reported with certainty from Florida.

Succinea avara Say.? With the above two or three specimens, Mr. Dall identifies them with doubt. The whorls are quite flat for that species, but they agree better with figure and description of this than anything in Binney's Manual.

Veronicella floridana Binn. Terraciea Island, around dwellings and under lumber.

Auricula pellucens Menke. Evans' plantation, on land occasionally covered by high tide, abundant; Lost Man's Point; mouth of Caloosahatchie River; Torch Key, plentiful on low ground.

Carychium exiguum Say. Found living in a low wet hammock near Palma Sola. Identified by Mr. Dall and Mr. C. F. Ancey. This is the first time, I believe, that it has been reported from Florida.

Melampus flavus Gm. North side of Manatee River, in salt ponds.

Melampus lineatus Say. North side of Manatee River; Cedar Keys, Upson.

Melampus lineatus, var. Both species and variety found with *M. flavus*.

Melampus caffeus L. Common. A very large and fine form was obtained abundantly on mud flats near Magill's Mound.

Melampus floridanus Shutt. Evans' plantation, with *Auricula pelluceus*.

Melampus floridanus, var. An elongated form, which is probably a variety of this, was found in salt ponds north of the Manatee River. It somewhat resembles in form a small *Detracia bulloides*.

Melampus (*Detracia*) *bulloides* Mont. Key West, abundant, though mostly dead; Red-fish Point.

Tralia (Alexia?) minuscula Dall.

"Shell minute, smooth, yellowish white, with about five whorls beside the minute, rounded, sinistral, half-immersed nucleus; spire moderately elevated, pointed; sculpture of fine regular impressed lines, parallel with the incremental striæ; suture distinct; last whorl with nearly parallel sides, rounded and slightly attenuated base; columella stout, strongly twisted, white, short, outer lip nearly straight, somewhat thickened, especially anteriorly, not lirate or denticulate internally; body with two revolving ridges, the posterior one fainter and placed in advance of the middle of the whorl; a slight wash of callus on the body; aperture about one-third as wide as the body whorl to the left of it, pointed behind, rounded and slightly oblique in front. Soft parts unknown.

"Lon. of shell, 3.8 mm.; of last whorl, 3.0 mm.; maximum diameter of shell, 2.0 mm.

"This interesting little species was found in the wash of the beach at Magill's Bay, Tampa, by Mr. Simpson, in moss in a dried-up marsh near Tampa, by Dr. Velie, and on the shores of the lagoon at Exuma Island, Bahamas, by Dr. J. J. Brown, and by the U. S. Fish Commission in 1885. The soft parts are unknown, and its reference to *Tralia* is, therefore, provisional only. It differs from *Tralia*, *sensu stricto*, as typified by *Tralia pusilla*, in the absence of the wave and internal ridge in outer lip. This, however, may be only a specific character. At all events, it is without the internal liræ of *Melampus*, etc., and until the character of the foot is known, may perhaps best be located in the above-mentioned group."

The above is Mr. Dall's description of this species. Only three or four specimens were found.

Pedipes naticoides Stearns. Beach at Magill's Mound.

Pedipes elongatus Dall. I found the last three species occasionally at the above locality, washed up in grass, with quantities of several species of *Truncatella*, *Cerithium nigrescens* and *muscarum*, *Columbella rustica*, and a number of other small species.

Blauneria heteroclita Mont. With the above; rare.

Linnæa humilis Say. Terraciea Island; ponds south of the Manatee River. Abundant. In the month of November, 1884, I found this species with eggs deposited on the outside of their shells. Also found near Tampa. Smaller and darker colored than those I have collected in the Northern States.

Linnæa columella Say., var. *casta* Lea. Pond near Fogartyville, Manatee County.

Physa pomilia Conrad. Ponds in pine woods, Manatee County.

Physa heterostropha Say. Ponds, Terraciea Island.

Physa elliptica Lea. Pond near Fogartyville.

**Physa gyrina* Say. Volusia County, Cunningham.

**Ameria scalaris* Jay. Sumpter County, Cunningham.

Planorbis trivolvis Say. Ponds on Terraciea Island.

Planorbis tumidus Pfr. Ponds south of Manatee River; sluggish stream in Cedar Hammock. A Cuban species also found in Mexico.

Planorbis Duryi Wetherby. Volusia County, Cunningham; Orange County, Pilsbry; Royal Palm Hammock, associated with *Ampullaria caliginosa* and *Cyrenoida floridana*, on a low wet prairie.

Planorbis exacutus, Say. Pine Level, Florida, in a swampy stream; young.

**Planorbis glabratus* Say. Mayport. Several beautiful shells were received from Mr. F. C. Sawyer.

Ancylus filosus Con. Ponds near Fogartyville.

**Ancylus obscurus* Hald. Ferguson's Pass, Hemphill.

Siphonaria alternata Say. Key West.

Siphonaria alternata, var. *brunnea* Hanley. Key West; abundant on rocks at high tide.

**Siphonaria lineolata* D'Orb. St. Augustine, Hemphill; East coast, Cunningham.

Dentalium disparile D'Orb. Dredged in seven or eight fathoms, in Tampa Bay.

Dentalium lubricum Dall. Tortugas.

Dentalium antillarum D'Orb. Tortugas; dead shells.

Dentalium coarctatum Lam. Tampa Bay.

Rocellaria ovata Sby. Two specimens were found burrowing in coral on Sand Key, Tortugas. One living example was dredged in Tampa Bay. Another was found burrowing in the shell of *Arca Noæ*, in Little Sarasota Pass.

Rocellaria rostrata Speng.? A living shell was accidentally broken on being taken from its burrow in the rocks on Little Content Key, which agrees quite well with the figure of this species.

Teredo norvegica Speng. Taken from timber in the Manatee River.

Xylotrya bipinnata Jeffr. Burrowing in lumber of the Floating Dry Dock, Manatee River.

Pholas costata L. Although this is a West Indian shell (it extends as far south as Patagonia), it seems to attain its greatest size and beauty at Cedar Keys, so far as I have examined specimens from the Florida coast. A shell from that locality in my collection is about eight inches in length, and very beautiful. Those in the vicinity of Tampa Bay are smaller, while at Cape Sable, where odd valves are washed up by the thousand, I did not find one over five inches in length.

Pholas truncata Say. West coast, occasional valves; and quite abundant at Cape Sable.

Martesia cuneiformis Say. A large number of shells were found by Mr. R. C. Stuart, on the West coast, in a floating palmetto log. I found shells at Long Key and Tortugas. Cedar Keys, Hemphill.

Martesia smithii Tryon. A fine shell was dug out of an old vessel in the Manatee River.

Solecurtus gibbosus Speng. Manatee River, on sandy, muddy flats.

Solecurtus divisus Speng. West coast; common.

Solen viridis Say. Manatee River; Tampa and Sarasota Bays.

Saxicava (*Paramya*) *subovata* Con. Dredged in Tampa Bay.

Corbula swiftiana Ad. Red-fish Point; Tortugas.

Corbula nasuta Say. Dredged abundantly in Sarasota and Tampa Bays.

Pandora trilineata Say. Something like one hundred and fifty living specimens and a number of dead ones were dredged in Tampa Bay. One or two valves were previously found washed ashore on Passage Key. Mr. Dall supposed this to be a new species, but found, on referring to Say's original figure and description, that it was the shell he had named *P. trilineata*, and that the heavy New England shell usually called by that name is undescribed.

Pandora (Kennerlia) bushiana Dall.

Pandora (*Kennerlia*) *bushiana* Dall. Rep. Blake Moll. Bull. Mus. Comp. Zool., XII., p. 312, September, 1886:

"Shell small, with the beaks very anterior; the anterior cardinal margin marked with a sharp keel, cutting off an almost lineal area; the margin descends from the beaks in a straight line, the basal curve commencing suddenly at a rather obtuse angle, then following an even curve, and slightly inflexed only near the posterior tip below the short, square-ended rostrum; the shell very thin, the left valve somewhat convex, the right one concave, both sculptured with silky concentric striæ; the margins of the two valves coincident; beaks small, hardly rising above the long convex arch of the posterior cardinal margin; the right valve with a strong keel on its upper posterior margin, and no other radiating sculpture, left valve with an impressed line from the beaks to the base, a little behind them, but which does not indent the basal margin; there is also a sharp thread from the beak to the lower angle of the rostrum; above this thread, as usual, the lines of growth are coarse.

"Lon. of shell, 11.5 mm.; of anterior portion, 2.0 mm.; height, 5.5 mm.; and diameter about 1.0 mm.

"This species, which differs from all others of the group known to me, in having the rostrum bent down instead of upward, and the posterior cardinal margin convex instead of concave, was dredged alive in six fathoms mud, Tampa Bay, Florida, by Mr. Charles T. Simpson."

The above is Mr. Dall's description of this new species, of which some half-dozen or more specimens were obtained. It was sent to him for determination, together with other small species.

Thracia rugosa Con. Long Key, one shell; mainland of Honduras, east coast, one shell. Mr. Dall thinks this may be *Thracia dictorta* Mont.

Periploma angulifera Sby. Tortugas, one shell; Egmont Key, several shells.

Lyonsia floridana Con. Common in Tampa Bay.

Lyonsia beana D'Orb. Sanibel Island, one shell; one shell found on the east coast of Honduras.

Mactra similis Say. West coast. The most common bivalve in the vicinity of Tampa Bay. It becomes less common to the southward.

Mactra fragilis Chem. Tampa Bay and vicinity.

Mactra oblonga Stm. West coast; rare. Several specimens were washed up at the mouth of the Manatee River, after a storm. The same shell was picked up on the east coast of Honduras. I cannot separate this from *M. fragilis* Chem., nor from shells with the latter name and authority received from the west coast of Central America.

Mactra lateralis Say. Occasional odd valves picked up on the West coast. A number of young living shells were dredged in Terraciea Bay.

Rangia cyrenoides Desm. I have never found this shell living. Fossil shells were occasionally collected on Egmont and adjoining Keys.

Labiosa lineata Say. Odd valves are rarely found on the West coast, especially the inner shore of Sanibel Island. I have a fine pair from R. C. Stuart, locality not known.

Labiosa canaliculata Say. Odd valves often found washed up on the West coast. Very common at Sanibel, where a few normal pairs were picked up.

Ervilia nitens Turton. Tortugas.

Ervilia concentrica Gld. Tortugas; Passage Key; Long Key.

Abra angulata Holmes. Egmont Key.

Abra æqualis Say. Varieties, Egmont Key.

Semele obliqua Wood. Egmont Key; young. A fine pair was picked up on Loggerhead Key.

Semele cancellata D'Orb. Dredged several pairs and odd valves in Tampa Bay. A peculiar pink variety was found on the inner shore of Anna Maria Key.

Semele reticulata Lam. Abundant at Long Key, and occasionally found elsewhere. At Loggerhead Key a rayed form was picked up.

Cumingia tellinoides Con. Anna Maria Key; Long Key; Tortugas.

Asaphis deflorata L. Tortugas, one shell.

Heterodonax bimaculatus L. Tortugas, one valve. This California shell was found abundantly at Utilla Island, Honduras, on sandy beaches.

Tellina magna Speng. West coast; rare. This magnificent shell was occasionally picked up on outside beaches, and two or three pairs were found in Long Boat Inlet, near Sarasota Bay. These shells are much darker colored than specimens I have from the Bermudas and the West Indies.

Tellina iris Say. Abundant; living on sand flats in Sarasota Bay.

Tellina interrupta Wood. Tortugas; Key West.

Tellina radiata, var. Tortugas.

Tellina decora Say. Rather common on the lower Keys. Several shells of this lovely species were found on Long Key.

Tellina decora, white var. Long Key.

Tellina tumida Sby. Red-fish Point, one shell; dredged in Tampa Bay; one shell found on the east coast of Honduras.

Tellina mera Hanley. Key West; Tortugas.

Tellina striata Chem. Cape Sable.

Tellina souleyetiana Recl. Dredged in Manatee River.

Tellina polita Say. Tampa Bay.

Tellina tayloriana Sby. Tortugas.

Tellina alternata Say. West coast; rare.

Tellina alternata, pink variety. One living shell was dredged in Tampa Bay.

Tellina levigata L. Mouth of Manatee River; small.

Tellina lineata Turton. Tortugas.

Tellina lineata, var. *albida* Hanley. Long Key.

Tellina brevifrons Say. Dredged in Tampa Bay.

Tellini gouldii Hanley. Tortugas.

Tellina punicea Born. Near Marco, one fine specimen; Cape Sable, abundant.

Macoma constricta Brug. Manatee River; Lost Man's Point.

Macoma anomala Desh. Long Key.

Macoma tampaensis Con. West coast.

Macoma fausta Dillw. Several fine pairs were found at Key West.

Macoma proxima Gray? Lost Man's Point.

Lutricola gruneri Phil. Odd valves were rarely found on the west coast. One perfect shell was picked up at Key West.

Strigilla pisum L. Key West; Tortugas. Variable in form and color.

Donax variabilis Say. West coast; very abundant on sandy beaches. This beautiful species lives between tides, and, in many places, every wave brings up thousands of them. As the wave retreats, they almost instantly burrow out of sight in the sand. A single handful of sand will often contain a dozen specimens. They vary through every hue of the rainbow, but their brilliancy soon fades on being taken from the water.

Donax denticulatus L. Key West.

Donax fossor Say. Mayport, J. B. Upson; West coast, occasionally; Anna Maria and Passage Keys.

Choristodon typicum Jonas. In corals, Sand Key, Tortugas.

Petricola divaricata Chem. Scattered valves, Tortugas.

dolomieu, Lacepede), channel-cat (*Ictalurus punctatus*, Rafinesque), common red-horse, or mullet (*Moxostoma macrolepidotum*, Le Seuer), and the pickerel (*Esox vermiculatus*, Le Seuer)—locally called "mountain-trout." Each of these forms is very abundant, the bass and pickerel apparently exceeding the remaining two in numbers.

To Dr. D. S. Jordan, of Indiana University, my thanks are especially due for his courtesy in examining and identifying the major portion of these species, and in the verification of others. Examples of most of the species, from many of the localities named, may be seen in the museum of the Indiana University, Bloomington, Indiana, and in the United States National Museum, Washington.

REGISTER OF SPECIES.

1. ICTALURUS PUNCTATUS, Rafinesque. (134.)*

Piney River, Texas County. Not seen in the streams of the southern slope, though it doubtless occurs in them.

2. CATOSTOMUS TERES, Mitchell. (170.)

Jack's Fork, Shannon County; Tom's Creek, tributary to West Fork of the Black River, Reynolds County. [See Jordan's Catalogue for notes on the relation of this form to *C. commersoni*, and the use of the name *teres*.] The specimens taken were none of them over one-third grown.

3. HYPERTELIUM NIGRICANS, Le Seuer. (171.)

Tom's Creek, Reynolds County; Meramec River, Dent County. Only young specimens taken.

4. MOXOSTOMA MACROLEPIDOTUM, Le Seuer. (185.)

West Fork Black River, Reynolds County; Jack's Fork, Shannon County; Meramec River, Dent County; Big Creek and Piney River, Texas County. This attractive sucker is very abundant throughout the interior of the continent. Very fine and large examples have been taken in the Des Moines and Raccoon Rivers, in central Iowa. It appears to be equally at home in the sluggish streams, characteristic of prairie regions, and in the clear and rapid streams of the mountains. It is largely used as a food-fish throughout the Mississippi Valley.

5. CAMPOSTOMA ANOMALUM, Rafinesque. (196.)

This most curious fish is exceedingly abundant in every stream in which collections were made. Unlike certain other fishes of wide dis-

*The numbers in parenthesis are those prefixed to the species given in Jordan's "Catalogue of the Fishes known to Inhabit the Waters of North America, North of the Tropic of Cancer," Washington, 1885.

tribution — *e. g.*, *Etheostoma cæruleum spectabile* — the very great variations which it presents are those of form and size, rather than of coloration. The differences between the sexes are marked, and especially so are those between the young and old males. Drs. Jordan and Gilbert have called attention to these features in their admirable "Synopsis of the Fishes of North America."* This species was, with the possible exception of the following form, the most abundant fish with which we met.

6. Chrosomus erythrogaster, Rafinesque. (202.)

West Fork Black River and Tom's Creek, Reynolds County; Sinking Creek, Spring Valley Creek, and Jack's Fork, Shannon County. In the smaller brooks and streams this beautiful cyprinoid was especially abundant. The very brilliant hues so characteristic of the species varied from pure white, on the ventral aspect, through all shades of coloration to bright yellow, orange, and red. In one locality particularly, in a mere rill tributary to Sinking Creek, the seine when landed presented a leaping mass of almost indescribable beauty of coloration. Hundreds of this richly-colored dace were taken at this locality — the richest found during the period of exploration. The males appear to be in the excess in point of numbers.

7. Dionda nubila, Forbes. (212.)

Tom's Creek, Reynolds County, and Piney River, Texas County. This form was described as *Alburnops nubilus*, from the Rock River, Illinois. It was placed in *Cliola* by Jordan and Gilbert in their "Synopsis," and finally, for reasons stated by Jordan in "Catalogue," p. 21, note 1, placed in *Dionda*. The genus, as now limited, "is characteristic of the Rio Grande region." The species is the most northerly one of the group. It was rare in our collections in Missouri.

8. Hybognathus meeki? Jordan and Gilbert. (214.)

Several specimens from the West Fork of Black River, Reynolds County, and Jack's Fork, Shannon County, appear to be this species. It is not an abundant form in this locality, and does not appear in the collections made at any other points. It is said by the discoverers to be "abundant in the Ozark region of Missouri and Arkansas." From this circumstance our identification may be erroneous.

9. Hybognathus nuchalis, Agassiz. (216.)

Piney River, Texas County, and Meramec River, Dent County. Two specimens only were taken.

*Bulletin U. S. Nat. Museum, XVI., 1882.

10. NOTROPIS DELICIOSUS, Girard. (233.)

Rare in Piney River, Texas County.

11. NOTROPIS NOTATUS, Girard. (258.)

This species was very abundant in each of the following localities: West Fork of Black River and Tom's Creek, Reynolds County; Jack's Fork, Spring Valley Creek, Barren Creek, and Sinking Creek, Shannon County; Piney River, Texas County.

12. NOTROPIS GALACTURUS, Cope. (262.)

This species occurred in sparing numbers in Jack's Fork, and in large numbers in Spring Valley Creek, Shannon County. This is the most westerly and southerly locality yet recorded for this species. Indeed, I am not aware that it has hitherto been reported from west of the Mississippi. Its bright steel-blue color, when moving rapidly about in the midst of schools of minnows, makes it a conspicuous object in the clear mountain streams which it inhabits.

13. NOTROPIS MEGALOPS, Rafinesque. (273.)

This form occurred in every stream in which collections were made. It is a singularly variable fish — some of its variations having received sub-specific or varietal designations. It is described by Jordan and Gilbert in "Synopsis," pp. 186–187, under the name of *Minnilus cornutus*, Mitchell.

14. NOTROPIS ZONATUS, Agassiz. (275.)

Abundant in all streams examined on both slopes.

15. NOTROPIS SCABRICEPS, Cope. (287.)

West Fork of Black River and Barren Creek, Reynolds County; Jack's Fork and Spring Valley Creek, Shannon County. This form and the two following occurred rarely. Of the three, this is the most generally distributed over the region explored.

16. NOTROPIS UMBRATILIS, Girard. (297.)

Spring Valley Creek, Shannon County. This is a little-known species, and occurred to us only in this single locality. It was originally described from the Arkansas River.

17. NOTROPIS MICROPTERYX, Cope. (311.)

This form occurred rarely in Spring Valley Creek, Shannon County. It is another of those mountain species now for the first time credited to the region west of the Mississippi. It was described from the "head-waters of the Cumberland and Tennessee Rivers."

18. SEMOTILUS ATROMACULATUS, Mitchell. (347.)

West Fork of Black River, Tom's Creek, and Barren Fork, Reynolds County; Spring Valley Creek, Shannon County; Big Creek, Texas County; Meramec River, Dent County. This is a very common chub in all streams, specimens of maximum size occurring in most localities where collections were made. The tubercles of the males had not all been lost in late June.

19. FUNDULUS CATENATUS, Storer. (569.)

This cyprinodont was very common in all streams on the south slope of the Ozarks, in all localities visited. It is another of those forms which were originally described from the mountain streams of the Alleghanies. The highly-colored caudal fins of the larger males were an especially attractive feature of the schools when swimming near the surface. They are powerful swimmers, often springing clear of the seine when brought near the banks for drawing. Especially large and fine specimens were taken in Jack's Fork.

20. ZYGONECTES NOTATUS, Rafinesque. (576.)

West Fork of Black River, Reynolds County, and Jack's Fork, Shannon County. Quite rare in the collections made in these streams, and all taken evidently males.

21. ESOX VERMICULATUS, Le Seuer. (598.)

Sinking Creek, Spring Valley Creek, and Jack's Fork, Shannon County. This species, which is locally called "mountain-trout," and occasionally "pike," is abundant in all of the larger streams in the mountains of Missouri. It delights to quietly loiter in the shelter of the pads of the pond-lily and in the shadows of the dense masses of *Potamogeton*, a few inches below the surface of the water. Motionless, in such situations, it awaits the coming of the unwary minnow, when, quicker than thought, it darts upon its prey, and, while you look, slowly sinks from sight. There is no apparent motion of fin or tail, but, ere you realize it, the "ravenous beauty" is gone. Its coming to the surface is as motionless and unexpected. Happening upon a favored locality, a somewhat deep expansion of Spring Valley Creek, upon the surface of which were dense growths of pond-weeds, with occasional clear spaces, one could, at any time during the early evening, see a half-dozen rising slowly to the surface. It was not long before we learned how dainty a supper a well-directed rifle-shot would provide. Sending the bullet a few inches under the waiting fish would throw him a yard out of the water, and before he recovered

from the shock he was seized. Neither this species nor the black-bass would take the hook, though ever so temptingly dangled in his very face; but the rifle, used by the botanist of the party as above described, supplied our table with "the best the streams had in stock."

22. AMBLOPLITES RUPESTRIS, Rafinesque. (845.)

While this species occurred in the collections in only the West Fork of Black River, Reynolds County, and in Spring Valley Creek and Jack's Fork, Shannon County, it no doubt occurs in every stream in the region traversed.

23. LEPOMIS MEGALOTIS, Rafinesque. (864.)

Jack's Fork, Shannon County.

24 MICROPTERUS DOLOMIEU, Lacepede. (877.)

This species was very abundant in all the streams visited. In the deeper portions of the clear, large streams, resting near the bottom, and motionless, could sometimes be seen a score or more full-grown specimens. Nothing could induce them to take the hook, nor were they easily alarmed. At this season of the year they appeared to move in schools, and when one was seen others were sure to be found in the immediate neighborhood. This form makes nests by bringing to a single point piles of pebbles and cobblestones, the river bottom, in favorable localities, presenting many such piles. The small-mouthed black-bass is sometimes called "trout" in Southern Missouri, but that name was more often applied to the pickerel, while the name "perch," for this form, appeared to be more commonly employed.

25. BOLEOSOMA OLMSTEDI OZARCANUM, Jordan and Gilbert. (885*e*.)

Jack's Fork, Shannon County, and Big Creek, Texas County. This very beautiful little darter occurred abundantly in Big Creek. It was much more rare at the other locality.

26. DIPLESION BLENNIOIDES, Rafinesque. (894.)

Jack's Fork and Sinking Creek, Shannon County; West Fork of Black River, Reynolds County. This species, usually abundant, occurred but rarely in our collections. The range of coloration is exceedingly variable, though green predominates. However, the Sinking Creek specimens presented but a *modicum* of that color, the dominating shade being yellow, with black or greenish-black sparsely-distributed blotches. A single specimen from Jack's Fork is almost entirely black, with hardly a suspicion of green. This specimen, too, was the largest taken, measuring fully five and one-fourth inches.

27. ETHEOSTOMA PUNCTULATUM, Agassiz. (933.)

Occurred but once only, in a small stream tributary to Big Creek, in Texas County.

28. ETHEOSTOMA CŒRULEUM SPECTABILE, Agassiz. (936*b*.)

West Fork of Black River, and Barren Creek, Reynolds County; Sinking Creek and Spring Valley Creek, Shannon County, and Big Creek, Texas County. This pretty darter occurred abundantly in each of the above localities. Its favorite haunt appeared to be in the shallow and muddier portions of small brooks and streams, where it found ready refuge under submerged leaves. In such localities it was obtained in the greatest abundance, especially when the lead-line scraped over the bottom, carrying quantities of leaves and other vegetable *debris* into the seine. In its brilliant coloration it presents a most infinite diversity, though many specimens are almost entirely black.

29. URANIDEA RICHARDSONI, Agassiz. (1320.)

Abundant in all streams, and especially so in Big Creek, Texas County. The remarks on the coloration of the preceding forms are equally applicable here. It is protective in a high degree, and only the closest scrutiny enables one to distinguish the fish in its native element. There is nothing brilliant in their coloration, but a great variety of sombre hues predominate.

The following species were taken later in the season, in October and November, 1886, in Bear and Hinkson Creeks, two characteristic prairie streams in Boone County, near Columbia. They are introduced here because so little is known concerning, not alone the geographic distribution of Missouri fishes, but also so little concerning what species occur in the State. In these two streams, in this locality, though the bottom is rocky, the water is turbid and sluggish:

1. CATOSTOMUS TERES, Mitchell. (170.) Hinkson Creek.

2. NOTURUS EXILIS, Nelson. (88.) Hinkson Creek.

3. CAMPOSTOMA ANOMALUM, Rafinesque. (196.) Bear and Hinkson Creeks.

4. LEPOMIS CYANELLUS, Rafinesque. (853.) Bear and Hinkson Creeks.

5. LEPOMIS HUMILIS, Rafinesque. (868.) Bear Creek; abundant.

6. BOLEOSOMA OLMSTEDI OZARCANUM, Jordan and Gilbert. (885*e*.) Bear Creek.

7. PIMEPHALES NOTATUS, Rafinesque. (219.) Abundant in Bear Creek.

8. PIMEPHALES PROMELAS, Rafinesque. (218.) Bear Creek.

9. NOTROPIS DELICIOSUS MISSOURIENSIS, Jordan and Gilbert. (233.) Bear Creek; abundant.

10. SEMOTILUS ATROMACULATUS, Mitchell. (347.) Bear Creek.

11. PHENACOBIUS MIRABILIS SCOPIFER, Cope. (316.) Bear Creek.

12. POMOXYS ANNULARIS, Rafinesque. (842.) Bear Creek; abundant.

13. MOXOSTOMA MACROLEPIDOTUM, Le Seuer. (185.) Hinkson Creek.

IOWA THUNDER-STORMS — NOTES FOR THE SUMMER OF 1887.

BY FREDERICK STARR, PH.D.

(*Read before the Academy, December 2d, 1887.*)

THIS report is very faulty. I present it, however, with the hope that the material it contains may not be entirely without value, and that some one, better qualified for the work than I am, may be led to undertake the study for another season.

These notes cover the three months from June 1st to September 1st. In the spring, a circular, with sample blank enclosed, was sent to such persons as I believed would be interested in the work. Favorable replies were received from about seventy persons. More than half of that number have really reported. It can readily be appreciated that so small a number cannot properly report so large an area. It is hoped that a larger corps of workers may be secured for another season. A list of observers who have actually reported follows:

Avey, O. H., Oskaloosa.
Baur, George, Middle River P. O.
Bennett, T. W., Lenox.
Boyd, Joseph, Oskaloosa.
Brackett, A. G., Denmark.
Brainard, D. W., Grinnell.
Brown, Caleb, Sac City.
Brown, W. J., Emmetsburg.
Coffey, W. T., Marion.
Collin, Alonzo, Mt. Vernon.
Crosby, James O., Garnavillo.
Dean, Mrs. Seth, Glenwood.
Dysart, Joseph, Dysart.
Elder, J. M., Concord.
Ellis, G. M., Emmetsburg.
Hunter, G. F., Hawarden.
Koontz, Alph., Albia.
Lahman, V. M., Wiota.
Larrabee, Rachel, McGregor.
Lewis, Melissa, Audubon.
Marks, T., Hopkinton.
Marshall, Gregory, Cresco.
McCready, Miss L. A., Ft. Madison.
Meeker, Roy, Marshalltown.
Miller, Edwin, Auburn.
Mitchell, L. E., Brush Creek.
Moore, W. W., Gillett.
Moulton, M. M., Monticello.
Mulford, A. M., New Providence.
Norelius, A., Kiron.
Olds, H. D., Cedar Rapids.
Payne, Wm. D., Tabor.
Perkins, C. G., Onawa.
Pratt, W. H., Davenport.
Prinelle, H. W., Ft. Dodge.
Raymond, H. F., Waterloo.
Reeves, M. L., Seney.
Renfrew, H. N., Bancroft.
Rice, Charles, Smithland.
Rice, Wilbur F., Adair.
Roberts, Luke, Clinton.
Sawyer, C. N., Orange City.
Schadt, Conrad, Amana.
Sears, P. W., Moravia.
Sheldon, S. G. F., Davenport.
Smith, H. D., Monticello.
Vogeli, Ad., Des Moines.
Walton, I. P., Muscatine.
Ward, William, Algona.
Wheeler, I. J., Monona.
Winchester, E. D., Stacyville.
Witte, Max E., Mt. Pleasant.
Wood, John A., Rock Branch.
Wuest, Peter, Homestead.

To all of these we give hearty thanks.

Not only is the number of reporters inadequate, but the reports are not always exact in the matter of time. This is of great importance, as errors in time records render it impossible to properly combine observations in making up the history of the storm. Some reports are valueless, on account of not being dated. The reports would be of much greater value with temperature observations and barometric readings. New blanks should have spaces for these, although all observers may not be able to make such record.

The circular and blanks were copied after those used by the signal service in 1886. They read as follows:

DAVENPORT ACADEMY OF NATURAL SCIENCES.

THUNDER-STORM OBSERVATIONS IN IOWA.

M———, ———, Iowa.

DEAR SIR: Knowing you to be interested in meteorology, from your being a ———, I address this note to you, asking if you will not undertake to report all thunder-storms occurring at your locality during this season, from June 1 to September 1. Certain suggestions follow. The fuller the report the better, though all the questions absolutely necessary to answer are on the enclosed blank.

Count storms six hours or more apart as different storms.

Note the time of first thunder, last thunder, and loudest thunder.

Note direction from which the storm comes, and that to which it goes.

The "scale" of intensity of storm is: 1. Distant lightning. 2. Distant thunder. 3. Moderate thunder-storm. 4. Heavy thunder-storm. 5. *Heavy*, with high wind. 6. Tornado.

Give length of time of rain.

Catch rain in a pail or can with vertical sides, and measure with rule.

Give particulars as to amount of hail, size and shape of stones, etc. Also time of *its* fall.

Much value attaches to *full* descriptions of clouds. Such reports are very interesting, though not absolutely required.

Scale of force of winds: 0. Calm. 1. Light, moving leaves of trees. 2. Moderate, swaying branches. 3. Brisk, raising dust. 4. High, blowing twigs from ground, swaying trees. 5. Gale, breaking branches, loosening chimney bricks. 6. Tornado, destructive.

Be sure to note every storm heard or seen, even though distant; its direction and time, if nothing more. Give details of lightning strokes.

A sample blank is enclosed. Each is for three storms. When filled, they are to be kept until five have accumulated, or until the end of the month. Then all are to be sent on.

Use "standard" time. Be as exact as may be to the minute. Always date carefully, and indicate morning or afternoon by A. M. and P. M. Always write in the blank the place of observation.

Please let me know at once if you will assist. I enclose card for your reply. Address

PROF. F. STARR,

Cedar Rapids, Iowa.

The last obstacle to the best results is found in the fact that the person superintending the work is not a professional meteorologist. He has, however, a great desire to see Iowa thunder-storms carefully studied. He believes it to be a subject that will repay diligent work; and if this report, faulty though it be, may stimulate interest in the study, he will be content.

Three kinds of thunder-storms seem to be reported:

First. Storms, well defined, traveling from the west, or a western quarter, toward an eastern quarter. Time records, properly made, supply data for calculating the rate of progress eastward. These are apparently connected with the general atmospheric circulation of the United States, and occur in the southeast quadrant of a "low" area.

Second. Heat storms, local in character; not showing a progressive movement; often unaccompanied by any wind; seldom beginning until well on in the afternoon, or in the evening. They accompany extreme hot weather.

Third. "Squalls," which are well characterized by Dr. Hinrichs in his "Bulletins" for June and July, 1882. His account has been quoted by others, but may again be copied here for Iowa readers:

"Our Iowa squalls are as serious as any on the ocean; the wind may be destructive, but it is not lifting nor revolving as it is in the tornado. Roughly speaking, the squall may be likened to an extended tornado, having its axis parallel to the ground. Here, in Iowa, it generally bursts upon us from the northwest, following the southeast wind; it rolls over and strikes down upon us, usually with abundant precipitation, and soon is succeeded by the same southeast wind which it so abruptly displaced. * * So far as I have studied them, they come down from the northwest, progressing at the rate of twenty to fifty miles an hour. In Northeastern Iowa, the storm has a tendency to bend up, so as to make the squall more nearly from the west. In like manner, in Southwestern Iowa its front bends westward, and hence blows more nearly from the north. The storm front is fierce in its power along a considerable distance — twenty to fifty miles, and more, in its front, along the earth, are struck simultaneously. As the great storm-front moves on, it can be traced for 350 miles from northwest to southeast through our State. It is impossible to confound this storm with the tornado, which is fortunately very restricted in its field, mowing a swath of destruction, generally, in a direction corresponding to the line of the squall storm-front, from a southwesterly toward a northeasterly point. The tornado is narrow, local; the squall at a given

instant reaches a narrow, long, extended belt of land like a tornado track, but this belt of destruction is carried forward with great velocity so as to gradually sweep over a large part of the State. Again, the squall of summer is radically different from the blizzard of winter. The squall comes, reaches us, and after a few minutes leaves us, moving onward in its general course toward the southeast; the blizzard blows for hours, and even days. In the squall, but a limited amount of air comes down from the northwest, a great roll of cold and dense air falls upon us; in the blizzard, the entire atmosphere covering several States is moving as one body toward the southeast."

In June, we had a considerable number of local thunder-storms, but few were marked by great rainfall or electrical disturbance. Local storms are reported for every day except the 1st, 15th, 17th, 22d, 23d, 25th, 27th. Some of these were reported from only one station. In but a few cases can the storms be shown to bear relation to a well-defined "low" area to the northwest. From the 4th to the 9th, the number of reports made show a disturbance the most marked on the 7th. A cluster of storms began on the 11th, culminating on the 13th. On the 18th we have a "squall," followed by storms on the 19th and 20th. The storms of the 20th are the most fully reported of the month. On the 30th, a number of storms are reported.

June 3d, 9:45 A. M., a storm struck Middle River P. O. It was of brief duration, and passed from south to northeast. The lightning was very sharp, and two barns west of Winterset were struck; one of them burned. In the afternoon, thunder-storms occurred through the whole southern border of the State. The rainfall was very small. The storm came from the southwest at all stations.

June 4th and 5th. The isobares on the morning map of the 4th are peculiarly bent, and suggest a feeble depression not represented. This is more marked on the 5th, and it is possible that the storms of those dates are connected with it. The reports of the 5th are the more numerous.

June 7th. The storm of the 7th lies in the southeast quadrant of a well-marked "low." On the 5th we see it forming central over Idaho, Wyoming, and Utah. On the 6th, it has moved to central, over Western Dakota, Nebraska, Northern Colorado, and Wyoming. On the 7th it went east, separating into two small areas, one of which stood over Eastern Dakota and Northern Minnesota, with Iowa to the southeast.

On the 10th there are scattering reports of a morning storm in the

western part of the State. Considerable rain fell — 1.83 inches at Smithland, beginning at 11:30 A. M.; 1.62 inches at Rock Branch, beginning at 11:05 A. M. At Albia a little rain fell, beginning at 6:00 A. M., and some at Tabor, beginning at 8:00 A. M. On the 11th, eleven reports show local storms of no great inportance. Only two of the reports show wind as high as "2." Many report no wind whatever. Little rain fell, except at Auburn, 2.99 inches; Ft. Dodge, 2.00; Middle River, 2.65. The beginning of rainfall was: Auburn, 8:00 A. M.; Ft. Dodge, 8:00 P. M.; Middle River, 9:15 P. M.

Of the 12th, quite a number of reports are at hand. They show local heat-storms. We have no record of temperatures. Moravia reports 91 degrees at noon. There were some early morning storms, but most of them came between noon and 6:00 P. M. Rainfall began: Smithland, 1:00–2:00 A. M.; Bancroft, 2:00 A. M.; Brush Creek, 10:00 A. M.; Cresco, 10:30 A. M.; Auburn, 12:30 P. M.; Moravia, 12:45 P. M.; Kiron, 1:00 P. M.; Adair, 1:54 P. M.; Tabor, 2:00 P. M.; Algona, 3:00 P. M.; Glenwood, 3:03 P. M.; Middle River, 3:30 P. M.; Smithland, 4:00 P. M.; Concord, 4:00 P. M.; Onawa, 5:25 P. M.; Cresco, 8:30 P. M.; Glenwood, 11:00 P. M. The rainfalls are: Bancroft, 1.50 inches; Cresco, 1.10; Auburn, 0.48; Moravia, 1.00; Kiron, 2.50; Adair, 0.25; Tabor, 0.18; Algona, 1.00; Glenwood, 1.40; Middle River, 0.30; Smithland, 0.73; Concord, 0.90; Onawa, 0.70. The highest wind reported was at Algona — force, "3." Most records show a calm. Glenwood — "Afternoon storm was a sudden down-pour from a local cloud; very little thunder and lightning." Kiron — "Storm came in three distinct showers." This storm was for many places a breaking up of the great drought.

This cluster of storms apparently culminated on the 13th. Twenty-five reports were received of this date. The storms set in a little before noon. Rainfall beginnings are reported from then till 6:00 P. M. These are most numerous between 4:00 and 6:00 P. M. The times are as follows: Albia, 1:00 A. M.; Grinnell, 6:45 A. M.; Amana, 9:25 A. M.; Homestead, 9:42 A. M.; Dysart, 9:10 A. M.; Mt. Vernon, 10:40 A. M.; Monticello, 11:40 A. M.; Smithland, 1:00 P. M.; Mt. Pleasant, 1:15 P. M.; Davenport, 1:25 P. M.; Clinton, 2:00 P. M.; Concord, 3:10 P. M.; Albia, 3:40 P. M.; Tabor, 4:00 P. M.; Cresco, 4:10 P. M.; Bancroft, 4:40 P. M.; Orange City, 4:46 P. M.; Auburn, 5:00 P. M.; Algona, 6:00 P. M.; Cresco, 6:00 P. M.; Albia, 7:15 P. M.; Algona, 12:00 P. M. The amounts of rainfall are: Albia, 0.25 inches; Grinnell, 1.00; Amana, 1.28; Homestead, 0.86; Dysart, 0.10; Mt.

Vernon, 1.35; Monticello, 0.89; Smithland, 0.13; Mt. Pleasant, 0.00; Davenport, 0.53; Clinton, 0.25; Concord, 0.25; Albia, 0.37; Tabor, 0.00; Cresco, 0.37; Bancroft, 0.66; Orange City, 0.25; Auburn, 0.03; Cresco, 0.33; Albia, 0.06; Algona, 0.05. Dysart and Monticello report wind at "*4*;" Albia, Cresco, and Amana at "3;" others lower; Smithland, "calm." Notes: Concord—"Commenced at *precisely* same time as yesterday." Algona—"For three days have had thunder-storms nearly all time after noon until daylight of next morning. All have passed to northeast." Cresco—"The above storms seem to be a continuation of those of yesterday." Albia—"Magnetic needle 15′ east at 8:00 A. M., and 22′ east at 9:00 A. M." Mt. Pleasant—"Moderate lightning and thunder. Lightning struck close by, in northeast, at 7:00 P. M. and at 9:20 P. M."

On the 18th, Iowa was in the southeast quadrant of a "low" area over Eastern Dakota and Western Minnesota. This is one of our typical "squalls." Hinrichs reports it as "extending over Northern and Eastern Iowa, locally, with heavy rain, thunder, and lightning." Unfortunately, the time records do not admit of a "portrait" of this storm. A few notes are here given. The day was the hottest of the month. At Brush Creek, the temperature at noon was 102°. Clinton—"Wind gusty, carrying clouds of dust high into the air. Rain began in a dash, and the wind abated soon after rainfall commenced." Cresco—"Storm clouds passing around all the afternoon; some, with much heavier rain than we had, passed both north and south of us." Algona—"Lightning struck frequently from clouds to earth. Four distinct thunder-storms to-day; all formed high up, and went to east. All the thunder-storms thus far in June, *except* that of to-day, were formed near by, high up, and seemed to gather force as they moved northeast; 'pocket clouds,' at 6:00 P. M., passing from southwest to northeast." Ft. Dodge—"Clouds look threatening; pass away with high wind; blue sky at 4:00 P. M." Concord—"Lightning in every point, except, perhaps, southwest; a continuous storm from west and southwest to northwest, north, northeast, east, and southeast; Thomas Jakonbek killed by lightning four miles north of here, at 5:00 P. M." New Providence—"Hail, north and nothwest, breaking small limbs from trees." Orange City—"Team killed, and driver (William Rombough, of Hull) stunned by lightning." Davenport—"About noon, the storm-line of stratus clouds was seen in the northwest, which slowly advanced until the storm broke at 5:45 P. M.; wind furious and broken, but storm did not seem able to pass over to the south, where a strip of blue

sky was visible all the time; ceased at 7:00 P. M., but still in the north, and highly colored by the setting sun; at 8:00 P. M., sharp thunder and lightning in the northwest, but the *storm* did not come until 1:00 A. M. of the 19th, when it was terrific, but without wind; showers continued until 5:00 A. M." Waterloo—"Two storms; the first was heard at 2:10 P. M., the second at 4:15 P. M. The movement was from the north to the southeast; wind quite heavy; storm gathered in the north and extended; very black clouds; very hot before storm; temperature changed suddenly before it rained much; heavy masses of vapor scud across sky very low, going to south." Davenport—"Thunder, 5:40–7:45 P. M., northwest to southeast; heavy dust storm; a second and third installment at 11:50 P. M., and early in morning." Amana—"Six sheep killed at one time, in South Amana." This storm was accompanied by hail: Bancroft, 5:31–5:32 P. M.; Mt. Vernon, "a few drops;" New Providence, "a little, about the middle of the storm;" Concord, 12:40–12:48 P. M.; Ft. Dodge, 2:15–2:30 P. M., "slight;" Marion, 4:30–4:36 P. M.; Grinnell, 4:48–4:55 P. M., "slight." The times of rain beginning are: Smithland, 8:00 A. M.; Orange City, 11:35 A. M.; Bancroft, 12:00 M.; Concord, 12:35 P. M.; Algona, 2:00 P. M.; Ft. Dodge, 2:30 P. M.; Monona, 3:00 P. M.; New Providence, 3:00 P. M.; Emmetsburg, 3:00 P. M.; Brush Creek, 3:00 P. M.; Garnavillo, 3:30 P. M.; Cresco, 3:40 P. M.; Dysart, 4:20 P. M.; Monticello, 4:25 P. M.; Marion, 4:25 P. M.; Amana, 4:35 P. M.; Mt. Vernon, 4:35 P. M.; Homestead, 4:45 P. M.; Grinnell, 4:45 P. M.; Muscatine, 5:30 P. M.; Davenport, 5:52 P. M.; Clinton, 6:00 P. M.; Mt. Pleasant, 6:30 P. M. The distance from Orange City to Davenport is about two hundred and fifty miles; the time taken by the squall to traverse that distance, six hours and twenty minutes; giving a rate of nearly forty miles per hour. The heaviest rainfalls reported are: Brush Creek, 1.10 inches; Garnavillo, 0.70; Dysart, 0.90; Monticello, 0.75; Marion, 1.30; Amana, 1.12; Mt. Vernon, 0.80; Homestead, 0.72; Muscatine, 0.68.

On the 19th and 20th, there were a number of reports. The 21st shows a well-defined "high" area over Wyoming, extending east, and giving the clear, stormless weather of the 21st to the 29th, inclusive.

The storms of the early morning of the 19th ought, perhaps, to be counted with the storm of the 18th. Hawarden, Homestead, and Davenport report a storm from the northwest at midnight, with rain lasting two or three hours. A later storm traveled from Ft. Dodge east and southeast to Grinnell, Amana, and Davenport. The first

thunder was heard at Ft. Dodge at 2:30 A. M., the last at 3:30 A. M.; rain began at 3:00 A. M. Amana—"First thunder at 7:50 A. M., last at 9:50." Davenport—"First thunder at 10:00 A. M.; rain at 10:30 A. M." The heaviest rainfall was at Ft. Dodge—0.50 inch. Hail fell at five and one-half miles southeast of Des Moines. Marshalltown reports "a storm from the south at 4:40 P. M., with 0.48 inch rainfall and high wind."

The 20th is well reported by thirty-six observers—two storms, apparently, one in the forenoon, the other in the afternoon. The rainfall times of storm "A" are: Rock Branch, 12:30 A. M.; Seney, 1:30 A. M.; Orange City, 1:45 A. M.; Wesley Township, 2:00 A. M.; Auburn, 2:00 A. M.; Ft. Dodge, 2:15 A. M.; Concord, 2:45 A. M.; Smithland, 4:00 A. M.; Cresco, 6:00 A. M.; Monona, 6:00 A. M.; Brush Creek, 6:00 A. M.; Dysart, 6:00; (Glenwood, 6:05 A. M.; Tabor, 6:40 A. M.); McGregor, 7:00 A. M.; Monticello, 7:00 A. M.; Mt. Vernon, 7:10 A. M.; Garnavillo, 7:15 A. M.; Marshalltown, 7:30 A. M.; Homestead, 9:23 A. M.; Amana, 9:25 A. M.; Oskaloosa, 10:30 A. M.; Albia, 11:20 A. M.; Moravia, 12:10 P. M. These indicate a well-defined storm moving east or southeast. The distance from Seney to Moravia is about two hundred miles; the time taken, nearly twelve hours; rate of travel, sixteen miles an hour. The wind was generally reported at "2" or "3" in force. Hail fell at Seney from 3:00 A. M. to 3:05 A. M., where this was the "fiercest storm of the season; wind very strong; lightning almost a continual flash all through the storm." At Moravia there was no wind. Storm "B" is reported that evening by several observers coming from the southwest or west and passing east. Rainfall began at Cresco at 3:40 P. M.; at Muscatine at 8:00 P. M. The average duration of rainfall was one hour. The greatest was at Monona: 0.50 inch; Muscatine, 0.47. Notes: Davenport—"Sharp thunder and lightning in north during the evening, but rain did not fall till in night." Cresco felt both the above, and had a third storm at 5:30 P. M.; "Distant thunder continuous throughout the day; cleared off at night after 8:00 P. M.; numerous small showers around all afternoon and evening." Hinrichs reports "men plowing corn killed by lightning, one in Madison County, one in Adams County."

The 30th was stormy in much of the State. We were then in the southeast quadrant of a well-marked "low," central over Dakota on that morning. This area combined later with another area further west. Low pressures to our northwest were fairly prevalent until July 5th, and storms are reported locally until that date.

The storms of the 30th are very local, and apparently without connection. The storms came, generally, from south, southeast, or southwest. The observer at Adair reports "very curious *bursting* and branching out lightning. The storm came from west and south, and was very threatening until nearly at point of observation, then the wind rose and blew as a south wind till the storm was over; it then changed to the northwest and blew for fifteen minutes with force of '4;' at 7:05 P. M. it changed in five minutes to southwest, with force of '4;' after ten or fifteen minutes it changed to east, with force of '2.'"

Hinrichs says of July: "Thunder-storms and rains frequent, but generally very local. The temperature rose gradually from the 11th to the 17th, and from the 26th to the 29th. On these hottest days, heat-storms, with rain, thunder and lightning, and locally high wind and hail, set in, greatly lowering the temperature. Storm of the 17th was most intense in southeastern Iowa; that of the 29th, in northeastern portions of the State."

Storms are reported in July for every date except the 6th, 7th, 15th, 18th, 23d, and 24th.

July 1st. Several local storms, in both forenoon and afternoon. None show well-defined form or progressive movement. Rainfall was heaviest at Monticello — 1.50 inches.

July 2d. Storms local — heat-storms. Out of seventeen reports, only one gives a wind as hard as force "3;" some *report* "no wind at all." Greatest rainfall at Clinton — 0.59 inch. Moravia — "Revolving clouds, rolling in every direction; upper strata white; lower strata dense."

July 3d. A fairly defined storm seems to have passed across the State from the southwest. Times of beginning of rainfall are: Tabor, 3:00 A. M.; Bancroft, 6:30 A. M.; Oskaloosa, 10:00 A. M.; Cedar Rapids, 11:45 A. M.; Amana, 11:50 A. M.; Homestead, 11:55 A. M.; Mt. Vernon, 12:50 P. M.; Hopkinton, 1:00 P. M.; Monticello, 1:20 P. M.; Cresco, 1:30 P. M.; Brush Creek, 1:40 P. M.; Monona, 2:30 P. M.; McGregor, 2:45 P. M. From Tabor to McGregor is about two hundred and seventy miles; time of passage by storm, eleven hours and twenty minutes; rate of travel, thirty-five miles per hour. There was *no* wind at Tabor; wind seems to have blown more and more as the storm passed to the northeast. At Brush Creek, Monona, and McGregor it is reported "high;" at Cedar Rapids, force "4." The rainfall varied. Tabor and Monona report over one inch; Amana, only 0.20 inch. Brush Creek reports "clouds very black; gale of wind, with slight hail, at 1:40 P. M.; storm went around to north and northeast very heavy; rain at 1:40 P. M. — 0.60 inch in ten minutes."

July 5th. A storm from the southwest and northwest passed to east. Time records vary. Hail fell. Tabor—"Hail small, doing little damage." Rock Branch—2:40 to 2:45 P. M.—"Little; hail did some damage to crops south and southwest of here, about three miles." Kiron—"Hail fell southeast and northeast; some damage to crops." These storms, whose beginnings cover time from 2:00 to 9:00 P. M., were accompanied by some wind, as at Albia and in the hail district.

The freedom from storms of the 6th and 7th was broken on the 8th. The "weather map" of that forenoon shows a "low" area to our northwest, over Dakota and Minnesota. Its influence is seen in the number of reports for that date. Two or three storms apparently occurred. Lenox reports: "8:30 P. M., lightning and thunder in southwest and northeast began simultaneously; clouds approached each other in southeast and then scattered; no rain here, but some eight miles south." Concord—"Several head of cattle and one colt killed by lightning." Monticello—"Considerable sheet-lightning."

July 9th. Apparently local storms, with considerable lightning. Davenport reports "ice-house struck and burned at Rock Island city, and smoke-stack of wagon factory struck at Moline, between 1:00 and 2:00 A. M." Moravia—"Four flashes of lightning approached the earth; one struck a fence-post, the other three killed ten head of cattle; six of these lay on the wires in one place, the others were twenty rods distant."

On the 10th but a single report is made. The weather map of this forenoon shows an area of "low" in Dakota. This worked to the southeast. On the 11th, the well-defined "low" area was in the northwest corner of Iowa. A number of *night* storms are reported on the 11th. These all came from the west quarter, and were accompanied by considerable wind in some cases. The rain beginnings were all between 6:00 P. M. and midnight. Reports say: Auburn—"First really severe thunder-storm of season; storms mostly at night." Algona—"Very heavy thunder and lightning." Cresco—"Distant lightning all around horizon after 9:00 P. M.; bulk of storm seemed to be in the north; temperature at 9:00 P. M., 82°, and at 2:00 P. M., 97°, being the hottest of the year."

July 12th. Night storms again from a western quarter. The rain beginnings are mostly between 6:00 and 8:00 P. M. *All* the reports fall between 2:00 P. M. and midnight. This storm was fairly defined, and comparison of rainfall times shows an apparent east and northeast movement, though there are some discordant times. The "agreements" are: Des Moines, 4:15 P. M.; Cedar Rapids, 4:00 P. M.; Marshall-

town, 5:30 P. M.; Hopkinton, 6:00 P. M.; Dysart, 6:00 P. M.; Homestead, 6:20 P. M.; Amana, 6:25 P. M.; Oskaloosa, 6:20 P. M.; Albia, 6:40 P. M.; Monticello, 7:30 P. M.; Brush Creek, 7:30 P. M.; Mt. Vernon, 8:45 P. M. Time from Des Moines to Mt. Vernon, four and one-half hours; distance, one hundred miles; rate of travel, twenty-two miles per hour. Wind was highest at Cedar Rapids, force "5;" Amana, Homestead, Oskaloosa, and Brush Creek report force at "4;" at *most* localities it was "2." The heaviest rainfall was 0.55 inch, at Hopkinton. A little hail fell at Amana and Homestead. At Amana "one horse and two foals killed by lightning, about one mile southwest of observer; they were found lying partly on barb-wire fence. Lightning also struck one house and two trees, in different localities around here. It was the most terrific and appalling thunder-storm we have had for years." Albia—"This afternoon at 4:22 the magnetic needle vibrating from 8′ east to 3′ west; motion kept up for ten minutes." Cedar Rapids—"Two buildings struck, not badly damaged."

Nineteen reports for the 13th show storms, very local in character, beginning mainly between 2:00 and 8:00 P. M. Very little rain, and no hail. No damage by lightning reported.

But one report on the 14th, and none on the 15th.

July 16th. Twenty-two reports received. Fourteen of these report rain, the rest are thunder and lightning at a distance. These storms were mainly in the western and northwestern counties. They came on in the early evening. Eleven of the fourteen rainfalls began between 4:00 and 10:00 P. M. At some points two storms occurred, but the thunder kept up between; so at Concord. Cresco reports "distant lightning all along the west, after 7:30 P. M., with distant thunder at intervals; the hottest day of the year—98° at 2:00 P. M., 84° at 9:00 P. M. Ordinary years, such a heat would be followed by a severe storm." (This came before daybreak.)

July 19th. Twenty-eight reports refer to this storm in southeastern Iowa. Rainfall beginnings were from 2:00 P. M. to midnight, mostly between 6:00 and 10:00, fifteen reports falling within those hours. The rainfall times are: Moravia, 5:50 P. M.; Cedar Rapids, 6:00 P. M.; Oskaloosa, 6:10 P. M.; Albia, 6:45 P. M.; Amana, 6:45 P. M.; Des Moines, 6:50 P. M.; Homestead, 6:40 P. M.; Mt. Vernon, 7:00 P. M.; Hopkinton, 8:00 P. M.; Dysart, 8:00 P. M.; Brush Creek, 8:30 P. M.; Monticello, 9:15 P. M.; Mt. Pleasant, 9:30 P. M.; Cresco, 9:30 P. M.; Monona, 10:00 P. M.; McGregor, 11:00 P. M.; Garnavillo, 11:00 P. M.; Denmark, 10:30 P. M. The heaviest falls are:

Des Moines, 2.00 inches; Homestead, 1.70; Monona, 1.50. Generally, the wind was high. Davenport (see extract below); Oskaloosa, "4;" Amana, "5;" Homestead, "5;" Brush Creek, "4;" Monticello, "5;" Mt. Pleasant, "3;" Cresco, "4;" Garnavillo, "4;" Denmark, "3." This storm was a local heat-storm. For several days the heat had been intense. Moravia reports "104°, 105°, 106°, 99°, 98° for two-o'clock observations, for several days." McGregor—"98° at noon of 16th, 84° at noon of 17th." The heat at Davenport had been so great as to lead to prayer for rain and cooler weather, in the Episcopal Cathedral. A little hail is reported at Amana and Homestead; small fall at Des Moines, 7:40 to 7:45 P. M.; considerable in vicinity of Davenport. Garnavillo reports: "Barometer fell on 16th 0.12 inch, on 17th none. Clouds came from southwest up against and over the lower wind current." Monona—"Brilliant display of lightning from 9:00 P. M. till after midnight; clouds appeared to gather from all directions; heavy thunder during night." Dysart—"Most brilliant lightning display in the south, extending one-third around horizon, seen here since the Grinnell storm; rain, only a sprinkle." Amana—"Four foals killed by lightning at High Amana, four miles west; found dead at barb-wire fence."

Davenport Democrat-Gazette: "The rain of yesterday and last night extended this time over the whole of Scott County. The storm of yesterday was accompanied by a wind that played havoc with grain-stacks, trees, and stock-sheds in various parts of the county. Barley and wheat stacks were tossed upon each other in places, and straw was scattered everywhere. Cherry and apple trees along Duck Creek were taken up by the wind and carried fifteen rods, some farther. Nor did wind alone do damage. Out in the direction of Mt. Joy, hail played a prominent part in the storm. The hail that fell ranged in size from a hazel-nut to a hickory-nut, and there were exceptional cases where they were as large as eggs. Mr. Fritz Rohlf, a farmer near Mt. Joy, stated this morning that he had ninety acres of oats which he intended to begin harvesting to-day, and the hail of yesterday stripped his oat-field most effectually. Such was the case wherever it hailed. There was but little hail in the direction of Muscatine County, but in portions of the northern part of this county a great deal of hail fell. The wind blew down fields of corn and leveled grain in the field very much. Hilly farm land was badly washed by the driving rain."

July 19th. A few reports show storms in the western part of the

State. Seney reports "very fierce flashes from 7:00 to 9:00 P. M." Kiron—"Lightning struck and killed a heifer, three miles northeast from here."

July 20th. The "weather map" shows a "low" central over Iowa, moving east, on that day. Local storms are reported from 2:00 to 8:00 P. M. Middle River reports "lightning at 2:30 P. M.; struck in a grain-field, raising a dust cloud."

July 21st. Local storms, mainly in the northwest part of the State, where the weather had been hot. Nearly all were early evening storms, rainfall beginning, in fifteen cases out of sixteen, between 2:00 and 10:00 P. M. Algona—"This storm formed high up; temperature at 12:00 noon, dry bulb, 86°, wet bulb, 83°; wind southwest."

July 22d to 27th. Only four reports for the whole period. The "weather map" of the 26th shows a well-defined little oval area of "low" overlapping the corners of Iowa, Dakota, and Nebraska. Hail, doing some damage to corn, is reported at Rock Branch. This place lies to the southeast from this area. While this "low" was well-defined, it did not last on into the 27th, but was dissipated.

On the 27th we have setting in a cluster of storms which culminate on the 29th. Eighteen reports are upon the storms of the 27th. Several refer to a morning storm in Northwestern Iowa. Rainfall times are: Seney, 2:00 A. M.; Auburn, "very early;" Kiron, 4:00 A. M.; Algona, 4:00 A. M.; Onawa, 4:00 A. M.; Bancroft, 4:10 A. M.; Smithland, 5:00 A. M.; Ft. Dodge, 5:30 A. M.; Concord, 6:00 A. M.; Emmetsburg, 8:45 A. M. At Seney, "hail fell from 2:15 to 2:25 A. M., half an inch deep—no serious damage; lightning very fierce through entire storm; rainfall, 3 inches (?)." Smithland—"Two cows killed, one mile east. Emmetsburg—"Lightning continued sharp during the rain, and seemed to extend all over. The clouds came from the southwest and northwest, and met west of here, *not* over here." Five scattering reports from diverse parts of the State relate to evening storms. Clinton reports 0.18 inch hail falling between 6:04 and 7:00 P. M. Is not *rain* meant?

July 28th. Twenty-five reports. Local heat-storms. Rainfall began in all cases between 10:00 A. M. and 8:00 P. M. At Concord and Albia, two, and at Cresco three, storms are reported, in the day. All these, however, began within the above time limits. No hail is reported. Concord reports, "from an elevated explosion, a wire clothes-line in Garner was melted asunder; several persons shocked." Oskaloosa—"Crabill killed by lightning; two horses killed; barn burned."

Rainfall generally *very* small. At Cresco 0.62 inch fell, and at Monticello, nearly an inch.

July 29th. Heat culminated. Storms occur very early in the morning, perhaps continuation of the last. Evening storm began between 6:00 and 10:00 P. M. This was one of the worst storms of the season. Albia reports: "Barometer falling this afternoon; thermometer 101½° at 3:00 o'clock, 101° at 2:00 o'clock, and 97° at 6:00 o'clock P. M." We were to the southeast of a long "low" area over Dakota and Nebraska on the morning of the 29th. This passed over Iowa during the twenty-four hours following, and was to our east on the 30th. Notes: Seney—"Lightning very fierce; struck an elevator here, and knocked down and badly injured three workmen, at 2:00 P. M.; storming, off and on, all day; no wind." Smithland—"Tree on river bank, forty rods east, struck by lightning." Marion—"One inch rain; southwest wind, '4.'" Algona—"House struck." Concord—"One cow killed, fifteen miles southwest; three horses and two cattle killed for George Clark, in Erin township; hard to describe storm; the severest we have had, in wind, thunder and lightning; from commencement, at 3:30 P. M., to 11:00 P. M., thunder could be heard at some point; lightning continuous, and in all points; storm severest at 8:00 P. M.; rain at 3:30, 7:30, and 9:00 P. M.; hot wind at 6:00 P. M.; and before the last rain, the clouds, coming from the southwest, were upper clouds." Cresco—"Frequent and vivid lightning all evening, in all directions, with occasional showers, until after midnight; very warm and close before storm; a severe squall from west-northwest at 6:10 P. M., accompanying first heavy rain, injuring wind-mills, tearing trees, etc." Algona—"Second storm of day; worst of season; at 6:30 P. M., terrific thunder and lightning; storm went southeast, with a great roar; wind like a gale." McGregor—"Very vivid lightning in the evening; wind changed from southwest to northwest before the storm, being blown rapidly across the sky; wind force, '4.'" Emmetsburg—"Clouds came up from southwest and northwest, very black; seemed to roll until they came together, then changed to light, smoky color, and looked like tornado; only a puff, however; the blackness gave way to light, and settled down to a steady rain; when the two storms came together there was a fearful commotion; it was a pretty sight." Algona—"Third storm of the 29th, 9:00 P. M.; this has been an electrical day; thunder all day; though not six hours apart, these are three distinct storms; all the storms this year come from southwest; this is strange, and never noticed here before during eighteen years." Cresco, Brush Creek, and

Monona report wind force as "5." Rainfall is: Monticello, 0.87 inch; Middle River, 0.20; Marion, 1.00; Concord, 1.10; Cresco, 0.27; Brush Creek, 0.60; Monona, 1.25; Kiron, 1.50; McGregor, 1.08; Ft. Dodge, 1.00; Emmetsburg, 2.50; Algona, 0.55; Garnavillo, 0.75.

This storm continued on into the early morning of the 30th. Rainfall beginnings are reported as follows: Dysart, 12:25 A. M.; Homestead, 2:30 A. M.; Amana, 3:00 A. M.; Cedar Rapids, 3:15 A. M.; Albia, 3:15 A. M.; Monticello, 3:30 A. M.; Mt. Pleasant, 5:40 A. M. Perhaps the average rainfall was 0.50 inch. Dysart—"6:00 to 11:00 P. M. of 29th, very vivid lightning in the north; no thunder till 1:10 A. M.; four or five columns of electricity seemed to extend vertically to the earth from the motionless clouds that hung there for four hours."

In August there are not so many reports as in June and July. Storms are reported for each day, except the 6th, 24th, 26th, and 28th, but on many days there is but a single report. A storm-cluster occurs on the 3d to the 5th, most marked on the 3d; another on the 8th to the 10th, culminating on the 10th. The 13th is fully reported. On the 16th we have several reports, and many on the 17th. A group of storms occurred on the 19th to the 21st, most reports being received on the 20th.

Prof. Hinrichs reports: "Thunder-storms nearly as numerous as rain-storms during first half of month, but rare during the last—cold decade. Much damage done to property and cattle by lightning, and several people killed. High locally destructive winds accompanied the thunder-storms of the 10th and 13th. Hail is reported only on the 3d, in Hancock, and very light on the 8th, in Osceola County."

Examination of the daily weather map of the United States Signal Service shows connection with the general atmospheric movements as follows: On the 3d we were to the southeast of a "low" overlapping the corners of Dakota and Montana. This traveled east, and on the 4th was past us on the north. On the 5th, a well-marked "high" area lay to our west; on the 6th it was over Iowa. No storms on that date. On the 10th, a long, oval "low" area lay to our northwest, extending from Colorado to Minnesota, and overlapping our northwestern corner. August 13th, a well-defined small "low" area was in Dakota and Nebraska, and on our extreme northwestern corner. This moved across Iowa during the following twenty-four hours. On the 17th, a storm gathered in a "low" center near St. Louis, Missouri. Can our storms have been affected by it? On the 20th and 21st, "low" areas lay to the west and southwest. That of the 21st was on the corner of the

Indian Territory, Texas, and Arkansas. It was elongated far to the northeast, and apparently controlled the weather in *that* direction.

August 3d. Scarcely any wind in storms of this date. At Albia and Concord a force of "3" is reported; at Davenport, "5;" at all other places "2" is the highest; many are "1." Some report "calm." Most observers report less than 0.20 inch rainfall. Marion, however, gives 1.00 inch, and Clinton 0.87. Times of rain beginning are: Concord, 9:45 A. M.; Stacyville, 10:15 A. M.; Algona, 11:00 A. M.; Cresco, 11:45 A. M.; Homestead, 12:48 P. M.; Amana, 1:00 P. M.; McGregor, 2:00 P. M.; Dysart, 2:10 P. M.; Marion, 2:15 P. M.; Oskaloosa, 3:00 P. M.; Davenport, 4:08 P. M.; Des Moines, 4:25 P. M.; Monticello, 4:50 P. M.; Clinton, 5:00 P. M.; Albia, 5:45 P. M.; Algona (second storm), 8:50 P. M.; Concord (second storm), 10:00 P. M. Hail fell at Concord, for less than a minute, at 10:00 A. M. The day was very hot. Algona—"Weather very sultry; wet and dry bulbs only 3° apart; temperature at noon, 93°; this afternoon it is very difficult to work—so sultry." McGregor—"Thermometer at 92° at noon." Dysart—"Two storms were seen gathering at 12:00 M.; the one in southwest, the other in the northwest; they seemed to meet here, or, rather, their extremities did, after main bodies of cloud had passed to the east." Clinton—"Lightning fired a barn in Lyons, at 6:00 P. M.; also one a half mile south of Low Moor.

The observer at Dysart, where a storm came from the southwest, with rainfall beginning at 1:30 A. M. on the 5th, remarks: "Storms that strike us in full force first appear *directly* in the west; rain came down very gently; the retreating cloud was visible until 6:00 A. M."

August 8th. Only four reports of rainfall, though several of distant thunder and lightning. These four are from the same section—reports coming from Algona, Concord, Bancroft, and Emmetsburg. The rainfall began: Emmetsburg, 11:30 A. M.; Algona, 6:00 P. M., and again at 11:30 P. M.; Concord, 8:30 P. M., and again at midnight; Bancroft, 11:30 P. M. High winds are reported at Emmetsburg and Bancroft; little or none at other localities. Hail is reported at Emmetsburg at 6:30 P. M., and at Bancroft at 11:30 P. M. At Bancroft—"Showers passing from 6:00 P. M. till midnight." Algona—"Lightning all night; thunder heavy; storm after storm, all night." Concord—"Two storms, at 8:30 P. M. and midnight; also a continuous storm of thunder and lightning until 2:00 A. M. of the 9th; about midnight, the German M. E. Church, in German township, was struck and badly injured; steeple demolished, and floors and other portions somewhat

injured—the worst I ever saw in a building; a meteoric display at midnight, with heavy explosion." Bancroft—"Temperature, 7:00 A. M., 73°; 2:00 P. M., 90°; 9:00 P. M., 74°; mean barometer, 29.90 inches; mean temperature, 77.7°." At Cresco, "rain began to fall at 3:30 A. M. of 9th—only 0.09 inch fell; distant lightning, from northwest to east-northeast, all the evening, from 8:00 P. M. to 11:00 P. M., and later; at 3:20 A. M., storm remarkable for the suddenness and intensity of electricity; very vivid lightning, and roar after roar of thunder, with deafening crash."

August 10, a day of great heat. Cresco reports it "the warmest day of the year. At 2:20 P. M., just before the storm-cloud, it was 101° in the shade (the hottest since 1874, *then* 102°)." Brush Creek—"Gale from south all afternoon, with mercury at 104° at 2:30 P. M., and 100° at 5:00 P. M." This storm, a violent one, seems to have been chiefly confined to the east central part of the State. The beginnings of rainfall are as follows: Cresco, 3:15 P. M.; McGregor, 5:30 P. M.; Brush Creek, 5:30 P. M.; Monona, 5:45 P. M.; Garnavillo, 6:15 P. M.; Cresco (second storm), 6:15 P. M.; Hopkinton, 7:00 P. M.; Des Moines, 7:30 P. M.; Monticello, 8:00 P. M.; Marion, 8:10 P. M.; Cedar Rapids, 8:45 P. M.; Amana, 8:45 P. M.; Homestead, 8:50 P. M.; Oskaloosa, 9:15 P. M.; Clinton, 10:00 P. M.; Albia, 10:00 P. M.; Mt. Pleasant, 11:30 P. M. This storm came from the northwest, and apparently traveled at the rate of eighteen miles an hour. Notes: McGregor—"Strokes at 6:30 P. M. and at 10:00 P. M.; several buildings struck within a few miles." Garnavillo—"Lightning struck telephone pole in front of house." Wind was heavy almost everywhere; "4" is the common report. At Oskaloosa, "tops of haystacks blown off and limbs of trees broken; the only storm of the summer to do any damage." Garnavillo—"Strong south wind all day; 5:30 P. M. it changed to northeast, then west; the rain came without violence; wind west during most of rains." Brush Creek—"Gale from west and northwest; gale from south all afternoon." Heavy rainfalls are reported from some stations: McGregor, 3.27 inches; Monona, 1.62; Hopkinton, 2.30; Monticello, 1.41; Clinton, 1.50. This becomes lighter, or even a "few drops" in the more southern localities.

August 12th. Reports from Emmetsburg, Smithland, Kiron, Onawa, Rock Branch, and Tabor show a storm in the western part of the State on the evening of the 12th. Time reports continue on into the 13th. There is not sufficient agreement between them all to prove a well-defined eastward-moving storm. They may be grouped so as to show several local storms, perhaps. The time records are: Smithland, 7:00

P. M.; Rock Branch, 8:40 P. M.; Onawa, 9:15 P. M.; Emmetsburg, night; Concord, 7:00 P. M.; Tabor, 4:30 A. M. of the 13th; Monona, before daylight; Bancroft, night; Stacyville, 5:00 A. M.; Ft. Madison, 6:30 A. M.; Davenport, 10:40 A. M.; Hopkinton, 11:00 A. M.; Clinton, 11:30 A. M.; Mt. Pleasant, 1:00 P. M., *13th;* Albia, 1:45 P. M.; Brush Creek, 3:40 P. M.; Mt. Pleasant (second storm), 6:30 P. M.; Middle River, 7:20 P. M.; Cedar Rapids, 8:50 P. M. There was little wind. Ft. Madison reports "6" (?); Emmetsburg, Concord, and Bancroft report "3." "Lightning struck barn near Denmark, burning it with all its contents."

August 17th. A few local storms. One in northeastern Iowa is reported as beginning at Stacyville at 11:35 A. M.; Cresco, 12:00 M.; Brush Creek, 2:00 P. M. Reports from Middle River, 11:40 A. M.; Des Moines, 2:20 P. M.; Dysart, 2:33 P. M.; Monticello, 4:00 P. M.; Amana, 4:20 P. M.; Homestead, 4:40 P. M., and Davenport, 5:55 P. M., harmonize fairly. Notes: Davenport—"Dust-storm, then calm." Dysart—"Sometimes thunder-clouds rise fairly in the west, and then divide, one portion swinging down Wolf Creek, and the other off to Iowa River."

August 19th. Reports inharmonious. In the early morning, at Ft. Dodge and Auburn, a storm is reported. Most, however, began in the evening and night, and some continued on into the 20th. There is a storm in the early morning of the 20th, between midnight and 6:00 o'clock, reported from nearly every part of the State. Wind at Ft. Dodge and Kiron, with force of "4;" at Smithland and Onawa, "3;" in all other parts of the State, light. Very little rainfall anywhere —0.50 inch at Kiron, 0.25 at Ft. Dodge, 0.23 at Smithland, and 0.15 at Onawa, being the heaviest. Afternoon and night storms are reported from four scattered stations. At Bancroft, "two persons riding on a horse-rake were killed by lightning at 2:30 P. M."

In concluding this very imperfect report, I may call attention to a few facts shown by the above:

First. In Iowa we have at least three well-defined varieties of summer thunder-storms.

Second. Our "heat-storms" generally come between 4:00 P. M. and midnight, but often have a *later* installment, which comes in the early morning.

Third. Local thunder-storms this year show very little wind. Frequently a calm may accompany a storm of some severity.

Fourth. The rainfall in many of these storms was remarkably light.

Fifth. There has been very little hail this year. Small amounts fell on June 18th, 19th, 20th, July 3d, 5th, 26th, 27th, August 3d and 8th.

Sixth. When our thunder-storms and hail show any connection with the "low" areas of the United States Signal Service weather map, we are generally in the southeast quadrant of such an area, and at a considerable distance from the center.

Seventh. Three cases are mentioned of dead horses found at the barbed-wire fence. I would like reference to similar cases elsewhere.

A DESCRIPTION OF THE ROCKFORD SHALES OF IOWA.

BY CLEMENT L. WEBSTER, STATE UNIVERSITY OF IOWA.

(*Read before the Academy, April 29, 1887.*)

Of the Devonian rocks of Iowa—and I might, perhaps, venture to say, the United States—there is no division more interesting to the paleontologist than the Rockford shales. The great variety and beautiful preservation of the fossil species contained in them, throw much light upon the history of the latter part of the Devonian age, in the northern part of Iowa.

It is a significant fact that many of the fossil species contained in the shales approach more nearly the European forms than do the forms from the same horizon in other portions of America. Some of the species, however, are peculiar to the shales, not being found, so far as is at present known, in the strata of any other portion of the world; and the fact that these beds contain some species whose extreme western limit of distribution was heretofore believed to be hundreds of miles to the east, contributes to their interest.

In this paper I have given, for the most part, only a general description of the strata which underlie the shales, in order that their relation to the shales may be understood.

The area of the shales is represented on the accompanying map. Whether they extend north of the limit indicated on the map, I am unable to say, as the surface is here everywhere so deeply covered by the drift that no exposure of the underlying strata is to be observed; and during the Quaternary period, they were considerably acted upon by the moving ice—so much so, indeed, that over limited areas they were removed nearly or quite down to the underlying strata. The accompanying map shows also the distribution of organic remains in the Devonian rocks underlying the shales.

The lithological characters, as well as the thickness of this formation, are somewhat varied in different portions of its area.

At Rockford and Hackberry, it attains a thickness of from twenty-five to forty-five feet, and is made up of thin-bedded, friable, very argillaceous limestones, varying in color from a light buff to a dark brown, which disintegrate very readily, forming a hard, dark yellow or buff-

colored clay, which, at Hackberry, contains numerous hard, dark red, ferruginous concretions, varying in diameter from one to four inches. The lowest twenty-five feet of the forty-five foot stratum at Hackberry is blue clay, which is mostly covered by a layer of shales.

On Flood Creek, at Rudd, in Floyd County, the shales are well exposed for a short distance in the east bank. Here the following section was taken:

1. Drift and detritus ..... 2 feet.
2. Yellowish brown (sometimes shaly), thin-bedded limestone, containing several species of corals, *Stromatopora*, *Spirifera*, etc., which are not known to occur in the shales at any other place, but which are more or less common in the limestone in other portions of the State ..... 4 feet.
3. Yellowish brown, argillaceous, shaly limestone, containing some sand, and numerous species of fossils, as *P. woodmani*, *O. iowensis*, *Luxonema*, *A. reticularis*, etc., and weathering to a yellow clay. This division passes imperceptibly into No. 2 ..... 5 feet.
4. Grayish-buff limestone, made up almost entirely of concretions of a harder and darker material, and containing numerous *Lamellibranchiata* (none of which are known to occur in the shales), with a few specimens of *P. woodmani* and *O. iowensis* at the top, to the bed of the creek ..... 9½ feet.

Total ..... 20½ feet.

In the bed of the creek, about one-half mile below the above locality, a small quarry has been opened in limestone immediately below number 4. Here measurements gave the following results:

1. Yellowish-buff, thin-bedded limestone ..... 3 feet.
2. Thicker bedded, grayish-blue limestone ..... 3 "

Both divisions contain the same assemblage of fossils, most of which are *Brachiopoda*. Only one or two of the species occurring in these beds are known to extend upward into the higher beds.

In the west bank of this creek, three miles south of the above locality, the shales are again observed. The beds here attain a thickness, by estimate, of about nine feet, and are made up of thin-bedded, somewhat friable, brownish-yellow, calcareous and argillaceous limestones, which contain an abundance of *Fistulipora occidens (?)*.

Underlying the shales is a nine-foot stratum (not well exposed) of limestone, which is apparently the equivalent of the concretionary limestone of the Rudd section.

In the extreme south-western part of Floyd County, and the south-eastern portion of Cerro Gordo County, the shales are much thinner,

and are less argillaceous than those portions of the beds which are exposed at Rockford and Hackberry. The fossils in this region are very abundant and finely preserved. The species *Naticopsis gigantea* attains a somewhat larger size and is more abundant than in some other portions of these beds.

On a small creek, at Owen's Grove, in Cerro Gordo County, the annexed section was taken:

1. Drift and detritus (sloping surface, probably concealing several feet of shaly limestone), by estimate..... 17 feet.
2. Soft, dark buff, somewhat argillaceous shaly limestone. 7 "
3. Blue shaly limestone, containing concretions..... 2½ "

Total..... 26½ feet.

About one-eighth of a mile south-west from this locality, on the same creek, is another limited exposure of the shales, which differ in some particulars from those exposed at any other locality, in that they weather to a rather soft, yellowish-white clay, and contain numerous *Lamellibranchiata* and *Gasteropoda* not known to occur in other portions of the beds.

Six miles east of Clear Lake, the shales are seen to outcrop on Willow Creek. They are here somewhat thicker bedded than usual, and vary from a dark buff to a dark brown color; they vary, also, from their equivalents previously described, at other localities, in being slightly sandy. The fossils are not numerous, and nearly all occur in the form of casts.

Two miles east of Clear Lake, the shales are observed as an outlier in a gently undulating prairie region, and present the same paleontological and lithological character (except that they are somewhat more friable) as at the exposure on Willow Creek.

Three miles west of Mason City, in the west bank of Willow Creek, the shales are again finely exposed, and at this locality the following measurements, by estimate, were taken:

1. Drift..... 1 foot.
2. Thin bedded, shaly, argillaceous limestone, containing some sand and casts of fossils, decomposing readily on exposure..... 20 feet.
3. Hard, stiff blue clay, containing numerous concretions of harder material..... 12 "

Total..... 33 feet.

The fossils contained in the shales at this place are comparatively rare, and occur only in the form of poorly preserved casts.

Over this portion of the area occupied by the shales, the deposition seems to have been more rapid than at other localities, and less well adapted to the preservation of the forms imbedded in it; and, inferring from the rarity of even the casts, the conditions would seem to have been less favorable to the existence of life.

The blue clay at this locality, as will be observed, occupies the same position relative to the shales as the blue clay at Rockford, hereafter to be spoken of.

The condition and thickness of the shales in Worth County is difficult, if not impossible, to determine, owing to the unusual depth of the drift deposit which everywhere occupies the surface. It has been reported to me, however, from an apparently reliable source, that the shales are well exposed at a locality some miles south-west from Northwood, in Worth County. I have not personally visited this locality.

That the relation of the shales and their contained fauna to the subjacent strata and its fauna may be better understood, I here give a general outline of that portion of the underlying beds which are included within the area mapped. The shales everywhere occupy the higher position, being overlaid by no rocks older than the Cretaceous.

The following section, taken at Rockford (in part compiled from Hall's Geological Survey of Iowa, Vol. I., Part I., page 309), will show the relation which these beds sustain to the underlying strata at this place:

1.	Drift, etc.	5 feet.
2.	Decomposing argillaceous shaly limestone, containing an abundance of beautifully preserved fossils	25 "
3.	Stiff dark blue clay, devoid of fossils	20 "
4.	A gently inclined surface, mostly unexposed, with buff and white striped shaly limestone at base	43 ft. 10 in.
5.	Unexposed	2 feet.
6.	Dark colored hard limestone	2 "
7.	White pure limestone, with shaly structure (usually very fine grained and brittle, and in places made up almost entirely of *Stromatopora*)	5 ft. 6 in.
8.	Hard buff calcareo-silicious sandstone, containing an abundance of *Streptorhynchus chemungensis* and *Spirifera disjuncta*, which occur in the form of casts, and all lying with a particular portion of the shell upward	3 feet.
9.	Rather soft ash-colored calcareo-silicious sandstone, containing casts of fossils*	2 "
10.	Somewhat arenaceous thin-bedded limestone	3 "
11.	Beds not exposed down to the level of Lime Creek	3 "
	Entire elevation	114 ft. 4 in.

* Three miles south of Rockford, the beds Nos. 8 and 9 are seen to outcrop in the north bank.

At Marble Rock, the limestone beneath the shales is well exposed in the bank of the Shell Rock, with a thickness of ten to fifteen feet or more, and is, for the most part, a rather thick-bedded, hard and fine-grained brittle limestone, varying from nearly white to dark brown in color, with scarcely a trace of fossils.

The rocks which underlie the shales adjacent to Rudd are thin-bedded, fine-grained and brittle limestones, varying in color from nearly white to dark gray, and almost devoid of organic remains.

About one mile below Charles City, in the eastern part of the county, the beds below the shales are well exposed at the "Marble Quarries" in the east bank of the Cedar River. The banks here rise to a height of about forty or fifty feet above the water in the river. The upper five or six feet is made up of rather thin-bedded, compact (sometimes brittle and crystalline) yellowish-gray limestone. The remaining portion of the outcrop is composed of hard, thicker-bedded, yellow or grayish-brown limestone (and sun-cracked shales), which is literally crowded with *Stromatopora*, and a few species of the more common *Brachiopoda*.* At this locality is quarried the rock from which the "Charles City Marble" is manufactured; the rock, as well as the masses of *Stromatopora*, taking a fine polish.

On the west side of the river, one mile above Charles City, there is an exposure of about ten feet of very hard, fine-grained and brittle limestone, with a more or less perfect conchoidal fracture. The layers vary in thickness from five to thirteen inches, and resemble each other so closely that they can hardly be distinguished in hand specimens, especially as all are unfossiliferous.

At numerous localities along the Cedar, for a distance of sixteen miles above Charles City, the limestone is well exposed, but as it approaches so nearly, in lithological characters and absence of fossils, that of the last section, detailed description is unnecessary.†

On the Cedar River in Mitchell County, the rocks beneath the shales are well exposed about one and a half miles west of Osage, the exposures ranging from forty to more than one hundred feet. The layers

of Beaver Creek, and, so far as could be observed, reach a thickness of only one or two feet. At Nora Springs, nine miles above Rockford, the same rock is seen to have a thickness of about seven feet; while two and one-half miles south, at the "Old Rowley Quarry," in the east bank of the Shell Rock, it attains a thickness of upward of eighteen feet. At these localities were collected *S. disjuncta*, *S. chemungensis*, *O. iowensis*, *A. hystrix*, *A. reticularis*, *S. demissa*, *Strobilocystites calvini*, etc.

* As will be seen by referring to the map, this is one of the few localities where fossil remains, in any considerable numbers, are found in the rocks underlying the shales.

† These rocks differ from those described in the last section only in being more or less crystalline.

are of very various lithological characters, varying from yellowish-white and often very heavy-bedded limestone, to dark, grayish-brown crystalline dolomite, with but very few and poorly preserved fossils.

In the north-eastern portion of Worth County, on Deer Creek, near Carpenter, the limestone exposed is rather unevenly bedded and slightly friable, varying in color from yellowish-white to dark grayish-brown, and, so far as observed, devoid of fossil remains.

In lithological character, the rocks outcropping along Rock Creek, in the south-western portion of Mitchell County, are very much like those observed at the locality one mile above Charles City, in Floyd County. The beds, however, are much thicker, and contain an abundance of fossils, represented by the genera *Strômatopora*, *Cyathophyllum*, *Favosites*, and a few of the more common *Brachiopoda*.*

On the Shell Rock, at Nora Springs, in Floyd County, there is an exposure of over forty feet of limestone, the beds of which vary somewhat in lithological character, but are, for the most part, fine-grained, compact, and more or less brittle limestone (some portions slightly magnesian), crowded with fossils, among which the genera *Favosites*, *Gyroceras*, *Paracyclas*, *Pachyphyllum*, *Stromatopora*, *Alveolites*, *Fenestella*, *Diphyphyllum*, *Atrypa*, and crinoid remains (representing two or three genera) were observed.†

At Rock Falls, in the north-eastern part of Cerro Gordo County, four miles above Nora Springs, the beds below the shales are well exposed. They consist of thin-bedded, hard, and rather crystalline magnesian limestone, varying in color from light gray to nearly black. The most careful search failed to reveal the presence of fossils. The lithological character of the rocks at this place is peculiar, and nothing exactly like it has been observed in any other part of the State. They are all highly magnesian, but not pure dolomites, as they contain rather more lime than belongs to the composition of the double carbonate of lime and magnesia.‡

The following section will give an idea of the general lithological character of the rocks underlying the shales in the region of Mason City, in Cerro Gordo County. It was measured on Lime Creek, three-fourths of a mile above Mason City:

* By referring to the map, this will be seen to be the second locality where organic remains are common in the rocks below the shales.

† Most of the species found here are restricted, in their vertical range, to the lower portion of the exposure; while about fifty per cent of the forms do not, so far as is now known, occur in the shales above.

‡ Hall's Geological Survey of Iowa, Vol. I., Part I., page 310.

1.	Rather hard, unevenly-bedded limestone, containing *Stromatopora* and *Favosites*	4 feet.
2.	Grayish or dove-colored fine-grained and somewhat brittle limestone	16 "
3.	Granular limestone, somewhat magnesian	3 "
4.	Uniformly bedded magnesian limestone	8 "
	Total	31 feet.

In no other portion of Iowa is the superficial covering of the rocks thinner than over a large portion of the area occupied by the four counties mapped. Not only are the rocks well exposed on most of the streams which traverse the region, but limited exposures are numerous adjacent to them, especially in Floyd County. For this reason, the underlying rocky strata can be studied with facility.

It may not be out of place here to give a short description of the only rock which overlies the shales at any place, so far as observed.

On Section 6, in Township 94 N., 18 W., Floyd County, there is an exposure of coarse-grained sandstone, forming, for a short distance, the north margin of a rather deep trough-shaped depression in the Devonian strata. This outlier is a very coarse-grained, friable, silicious sandstone, interstratified with fine, angular gravel (the angles being more or less rounded), while some of the beds exhibit beautiful examples of ripple-marks.* This rock varies in color from grayish-white to very dark yellowish-brown, and in some places is capped by vesicular conglomerate. The bed, so far as could be made out, attains a thickness of from thirty to seventy feet, the upper portion of which is thin-bedded and very much disturbed and broken up, being tilted at almost every conceivable angle, and overlaid at one place by a grayish-white limestone. The lower portion of the stratum is heavy-bedded, and dips at an angle of about twenty-two degrees, in a direction a little west of north.

The section shown by Figure 2, across this depression or valley from north to south, will show the position which the sandstone occupies in relation to the depression and the Devonian strata, the thin-bedded horizontal rock representing the Rockford shales, and the heavier strata beneath representing the subjacent limestones. The trough-like depression, which is in part bordered by this outlier, has an easterly trend, and finally unites with the valley of the Shell Rock. Its average width is about three-fourths of a mile, and its depth from forty to

* This rock is rather peculiar, and nothing exactly like it has been observed in other portions of the State. I have referred it to the Cretaceous, with some doubt as to its true age, since it is quite unfossiliferous.

seventy feet. It is believed that this depression was at one time entirely filled by this sandstone, and subsequently eroded by the action of the ice and the waters derived from the melting of it, during the glacial period.

That a better understanding of the richness of the Rockford shale fauna and its relation to that of the subjacent strata may be gained, I append a partial catalogue of the forms known to occur in them.* A large percentage of the species enumerated have not been catalogued by previous writers; but my own collection, made personally, embraces all but one or two of the species listed, and these I have examined in the cabinets of others who have personally collected them.

The species followed by † occur in the rocks which underlie the shales, but do not extend upward into the shales. Some of those followed by ? are undescribed forms, while others occur in the form of casts, making their specific identification uncertain.

Stromatopora incrustans, H. & W.
Stromatopora expansa, H. & W.
Stromatopora solidula, H. & W.
Ambonychia———†?
Caunopora planulata, H. & W.
Rhynchonella venustula,† Hall.
Tellinomya——?
Fistulipora occidens, H. & W.
Alveolites rockfordensis, H. & W.
Aulopora iowensis, H. & W.
Cladopora robusta,‡ Rom.
Aulopora saxivada, H. & W.
Zaphrentis solida, H. & W.
Campophyllum nanum, H. & W.
Aulopora———?
Cypricardinia sublamellosa? H.
Stromatopora———?
Chonophyllum ellipticum, H. & W.
Cystiphyllum mundulum, H. & W.
Chonophyllum———?
Spirorbis arkonensis, Nich.
Spirorbis omphalodes, Goldfuss.
Pleurotomaria———?
Acervularia inequalis, H. & W.
Smithia johanna, H. & W.
Smithia multiradiata, H. & W.
Callonema lichas? H.
Stromatopora alternata, H. & W.
Crania famelica, H. & W.
Pachyphyllum woodmani, White. §
Strophodonta arcuata, Hall.
Gyroceras———†?
Orthoceras vastator, Hall.
Orthoceras procerus, Hall.
Strophodonta canace, H. & W.
Strophodonta variabilis, Calvin.
Crypt̃onella eudora, Hall.
Dictyonema———?
Strobilocystites calvini,† White. ¶
Spirifera ziczac,† Hall.
Strophonella reversa, Hall.
Fenestella———?

* Aside from the species herein listed, we have in our cabinet over *eighty* additional forms from the shales, most of which are undescribed.

‡ The individuals of this species are exceedingly rare in the shales, and constitute the only representatives of the genus *Cladopora* yet obtained here.

§ This species is not very abundant in the shales, and is somewhat limited in its geographical range. It sometimes occurs in the limestone immediately underlying the shales.

¶ This species was collected by me from the sandstone which underlies the shales, at Nora Springs. It differs from the forms of this species collected at Iowa City, Iowa, mainly in being somewhat larger. It is of much interest to note the wide distribution of this rare species in the Devonian rocks of this State.

Streptorhynchus chemungensis, Con.
Orthis impressa, Hall.
Productella truncata, Hall.
Spirifera whitneyi, Hall.
Spirifera hungerfordi, Hall.
Spirifera orestes, H. & W.
Platystoma———?
Tentaculites———?
Spirifera cyrtiniformis, H. & W.
Spirifera fimbriata, Con.
Leperditia———?
Atrypa reticularis, Lin.
Spirifera disjuncta,† Sow.*
Orthis———?
Atrypa hystrix, Hall.
Stenochisma contractum, *var.* saxatile, Hall.
Loxonema———?
Leiorhynchus———?
Leiorhynchus iris, Hall.
Ambocælia umbonata, Con.‡
Gypidula occidentalis, Hall.
Paracyclas———†?
Euomphalus———?
Loxonema pexatum, Hall.
Orthoceras———?
Athyris vittata, Hall.§
Terebratula navicella, Hall.
Cryptonella calvini, H. & W.
Aviculopecten———?
Naticopsis gigantea, H. & W.
Crania———?
Favosites———?
Paracyclas sabini, White.
Spirifera macbridei, Calvin.
Platystoma lineata, Con.

Plates of Placoderm fishes allied to *Dinichthys*, and the teeth of other species of fishes. There are also the remains of at least ten species of crinoids, many of which are common both to the shales and the underlying limestones.

The view that some of the fossil forms found in the shales were "drifted in," is advanced by some geologists. I can see no good evidence for this hypothesis, however. I do not, at the present moment, recollect of a single species (with the exception of *Atrypa reticularis*, which occurs in the Niagara) occurring in the shales which is represented in any other rocks, either above or below the Devonian. Neither have I observed more than twenty or thirty species (none of the "drifted" ones are included) to occur in the rocks which immediately underlie the shales, that do not also occur in the shales themselves.

The bedding of all the Devonian rocks, in this part of Iowa, including the shales, is nearly or quite horizontal, showing no evidence of disturbance at or subsequent to their formation. Any agency sufficient to transport these forms from a distance, would also seem capable of leaving a record of its action upon the shaly beds which contained them. But if they were "drifted in" by the ordinary action of the sea, it is evident that they would have been too poorly preserved to be identified even as fossils.

* This species occurs throughout the sandstone at Rockford and Nora Springs, but is not found in any of the rocks which underlie or overlie it.

‡ The discovery of this species in the Rockford shales is of much interest, as I believe its extreme western limit has been heretofore believed to be in the vicinity of Widder, Ontario.

§ This species was not before supposed to occur so far north in the Devonian rocks of Iowa.

It is true that a few of the more common *Brachiopoda* and corals found in these beds were worn and smoothed by attrition before being imbedded; but if those forms (mostly *Lamellibranchiata*) which are supposed to have been transported had been subjected to the same action, all traces of organization would have been obliterated.

Again, there is no evidence that any of these forms were brought in living, as their remains do not occur outside the shales.

It seems, then, that only one inference can be drawn, and that is, that all of the forms found in the shales were indigenous; that all of the individuals lived, died, and became imbedded where they are found to-day.

From the general lithological characters of the shales, it would seem that they originated as a shallow shore deposit formed at about the close of the Devonian age in Iowa. The organic life of the old Devonian sea, in this portion of its area, culminated in these beds, the underlying rocks, for the most part, being singularly devoid of fossil remains.

MOUND EXPLORATIONS IN NORTHWESTERN IOWA.

BY FREDERICK STARR, PH.D.

(*Read before the Academy, June 24th, 1887.*)

In November last, I had an opportunity of examining some remains in Lyon County, in the extreme north-west corner of Iowa. These have no great antiquity, but present some points of interest. The locality is on the Burlington, Cedar Rapids & Northern Railroad, a mile beyond "LaValley" station, or "Brown's." The spot lies near the Little Sioux River and from it we may look across into Dakota, where ridges with similar mounds may be seen. The remains occur on a ridge, and consist of a great number of mounds and peculiar stone circles.

The following description sums up my own explorations and those of Messrs. Nash and Cotton, surveyors in the employ of the railroad company.

The mounds are mostly round, from thirty to fifty feet diameter, and from three to eight feet high. Some few are oval and larger than the above figures. There are very many of these mounds with no regular arrangement. Upon the summit of the ridge there are great numbers of "stone circles." These are made of boulders laid with some care and sunk some distance into the ground. *Some* mounds are scattered around among these circles, but most of them surround the circle-dotted area in a rude oval. The whole ground around the mounds and circles is strewn with flint flakes, arrowheads, scrapers, potsherds, etc. Stone mauls of good workmanship are found in the neighborhood.

To particularize, we opened two mounds — Nos. 1 and 2 — and have most of the specimens found in two others — 3 and 4. In Mound No. 1 the material was a hard gravel, difficult to dig. Patches of ashes were found. At a depth of two feet was found a skeleton with head to the north and body stretched to the south. All the bones were found in fair preservation. No "relics" were discovered.

The following structure was found in No. 2: 1, gravel; 2, black soil; 3, ashes and black soil; 4, gravel. Some fragments of bones and some potsherds were found in the second and third layers.

Mounds 3 and 4 were alone, on a lofty ridge, south of the railroad. No. 3 yielded skeletons of two adults and one child; also the bones of a horse. A pipe was found here also. Deeper digging procured another skeleton (adult), and a dog's skeleton wrapped in buckskin. The relics were six iron bracelets, fifteen feet of wampum, a grinding stone and a red pipestone pipe. The skeleton had ear-rings of copper attached to the head. Where the copper had oxidized, the skin and hair were preserved. This very peculiar specimen is now at Burlington. This mound was enclosed within a stone circle.

Mound No. 4 yielded a "stone wheel," an arrowhead, a pretty little maul of reddish granite, part of a jar, and some very *hard* bone fragments. A line of stones was laid across each end of this mound, the lines being six or seven feet apart. The stone wheel deserves description. It is perfectly true and elegantly polished. It is of a dark, fine grain, solid stone. Its sides — *i. e.*, top and bottom surfaces — are concave; its rim, a perfect circle in outline, is convex in surface. The specimen is six inches diameter and is perforated by a half-inch hole at the centre. At the outer edge the *thickness* is about one and one-half inches; at the inner edge one-half inch or less. This stone was evidently used in some pitching game, and is as fine as any of the southern specimens of the same kind.

Regarding the stone circles, I copy from my note-book: One, near Mound No. 1, was elliptical. It consists of one hundred and ten boulders, averaging a foot in diameter. They are set almost close together, and are of all kinds — quartzite, granite, gneiss, schist, etc. In another, the stones are nearly all of the same kind. In a third, two feet intervene between boulders. One circle was sixty-three by thirty-seven feet, and contained one hundred and ninety-seven stones. Nearly all the circles have an "opening," one to four and a half feet wide, at the south-east. Some few are "double" — one circle concentric with another. Some have "guard stones" at the openings. Some circles are confluent, and have some boulders in common. One group of confluent circles contains seven, of which two are "*double*." These circles are generally supposed to be lines of stones to hold tent edges down. I am not entirely satisfied that this is so. The fact that nearly all the "openings" are to the south-east, while the prevailing wind is north-west, seems to favor this theory. But if it is true, how shall we account for the circle around Mound 3, the lines of stones upon Mound 4, or the very peculiar little circle on a steep side-hill, where a great granite boulder is surrounded by a ring of smaller boulders, not accu-

rately round, but somewhat heart-shaped? It is evident that *all* are not "tent anchors."

A missionary of the American Sunday-school Union tells me that stone mauls are yet common among the Dakotas, who use them in preparing food. Choke-cherries are gathered, pounded to a pulp with these mauls, kneaded into cakes, and dried. Also, a peculiar tuber, with a structure somewhat like an onion, is gathered. The outer skin is husked off, and the rest pounded into a meal, which is mixed with water, moulded into cakes, and cooked. These are not the only functions of such "mauls." Indian implements are remarkable for their manifold uses.

The state of the bones, the condition of the wampum, the preservation of the buckskin, the occurrence of iron, the presence of the skeleton of a horse, all go to show that there is no great antiquity for these remains. The story told is of a Dakota village, populous and active; tents of skins, anchored by boulder-stones; arts of pottery making, stone polishing, and flint chipping, fairly developed; trade carried on with the whites to the east; the dead buried in mounds on the outskirts of the town; date, fifty to one hundred years ago.

PRELIMINARY ANNOTATED CATALOGUE OF THE BIRDS OF IOWA.

BY CHARLES R. KEYES AND H. S. WILLIAMS, M.D.

Read before the Academy, December 30, 1887.

In presenting the following catalogue of the Birds of Iowa it is proposed to offer a preliminary statement of a more extended account of the birds of the State, now in course of preparation. It is hoped that Iowa students and collectors who are interested in ornithology, and into whose hands this paper may fall, will give all possible aid both by furnishing notes and local lists, and by the loan of such specimens as may be desired for examination. It should be borne in mind that only such species are inserted as have come under the personal observations of the writers; and, for the most part, skins or mounted specimens of the species herein enumerated, are to be found in their collections. While there have been species observed which it has been hitherto impossible to secure, it has been thought advisable not to list them until there is material in the collections which would corroborate any statements made in regard to them. For this reason a number of forms which, in all probability, occur within the limits of the State have not been mentioned.

The observations, of which the present paper is a résumé, were made chiefly in the vicinities of Charles City, Des Moines, and Iowa City; and these have been supplemented by notes made by the writers at various times in different parts of the State. The dates of arrivals and departures are based entirely upon studies conducted in the vicinage of Des Moines. Although possessed of extended notes from other parts of the State upon the appearance in the spring and departure in the fall of the various species of birds, the notes from Des Moines have been exclusively used because of its central location in Iowa, and, therefore, representing nearly a mean for the arrivals and departures over the whole State.

The nomenclature and classification is that adopted by the American Ornithologists' Union, in its check list of North American Birds. Reference, by number, is also made to Baird's Catalogue of North American Birds, 1858, (B); Ridgway's Catalogue of 1881, (R); Coues'

Check List of 1882, (C); and the check list of the American Ornithologists' Union of 1886, (U).

Order PYGOPODES. Diving Birds.

Suborder PODICIPEDES. Grebes.

Family PODICIPIDÆ. Grebes.

Genus COLYMBUS Linnæus.

Subgenus DYTES Kaup.

[B 706, R 732, C 848, U 3.]

Colymbus auritus Linn. Horned Grebe. A rather common migrant; not as yet observed breeding within the limits of the State.

[B 707, R 733 *a*, C 850, U 4.]

Colymbus nigricollis californicus (Heerm.). American Eared Grebe. Occurs in some portions of the State, but is not very common.

Genus PODILYMBUS Lesson.

[B 709, R 735, C 852, U 6.]

Podilymbus podiceps (Linn.). Pied-billed Grebe. Common summer resident; breeds in "sloughs." On June 2, 1885, a fine set of eggs was taken in a grassy marsh near Des Moines. The nest was composed of decaying vegetable matter, and was placed in the water among the stems of Indian rice *(Zizania aquatica)*. It was about fifteen inches in diameter, and raised about three inches above the surface of the water. In the center of this mat, or nest, was a slight depression in which the eggs were placed.

Suborder CEPPHI. Loons and Auks.

Family URINATORIDÆ. Loons.

Genus URINATOR Cuvier.

[B 698, R 736, C 840, U 7.]

Urinator imber (Gunn.). Loon. Migratory; rather common. Said to breed in the northern part of the State, in the vicinity of the larger "lakes."

Order LONGIPENNES. Long-winged Swimmers.

Family LARIDÆ. Gulls and Terns.

Subfamily LARINÆ. Gulls.

Genus LARUS Linnæus.

[B 661, R 666 *a*, C 773, U 51 *a*.]

Larus argentatus smithsonianus Coues. American Herring Gull.

Common spring and fall migrant arriving about the last of March and passing southward again about the third week in October. It often appears in flocks of a score or more but is more commonly noticed singly, or in companies of three or four, flying about over the rivers in search of food.

[B 664, R 669, C 778, U 54.]

Larus delawarensis Ord. Ring-billed Gull. Common about the lakes of Northern Iowa where it is said to breed.

[B 668, 669, R 674, C 787, U 59.]

Larus franklinii, Sw. & Rich. Franklin's Gull. Migratory; rather common. Doubtless breeds within the limits of the State. Mr. J. W. Preston found this species breeding at Heron Lake, Minnesota, a few miles from the northern boundary of Iowa.

SUBFAMILY STERNINÆ. TERNS.

GENUS **STERNA** LINNÆUS.

SUBGENUS STERNA.

[B 691, 686, R 685, C 798, U 69.]

Sterna forsteri Nutt. Forster's Tern. Migratory; common. In Central Iowa this species arrives about the first of May and is to be seen gliding gracefully over the rivers and small lakes in search of food.

GENUS **HYDROCHELIDON** BOIE.

[B 695, R 693, C 806, U 77.]

Hydrochelidon nigra surinamensis (Gmel.). Black Tern. Spring and fall migrant; abundant. Breeds, especially in the northern part of the State about the grassy marshes and lakes.

ORDER **STEGANOPODES.** TOTIPALMATE SWIMMERS.

FAMILY **PHALACROCORACIDÆ.** CORMORANTS.

GENUS **PHALACROCORAX** BRISSON.

SUBGENUS PHALACROCORAX.

[B 623, R 643, C 751, U 120.]

Phalacrocorax dilophus (Sw. & Rich.) Double-crested Cormorant. Spring and fall migrant; common. Breeds in the northern portion of the State.

FAMILY **PELECANIDÆ.** PELICANS.

GENUS **PELECANUS** LINNÆUS.

SUBGENUS CYRTOPELICANUS REICHENBACH.

[B 615, R 640, C 748, U 125.]

Pelecanus erythrorhynchos Gmel. American White Pelican. Spring

and fall migrant; abundant. Often appears in large flocks, settling sometimes in such numbers upon the lake shores as to resemble drifts of snow, when seen from a distance.

Order ANSERES. Lamellirostral Swimmers.

Family ANATIDÆ. Ducks, Geese, and Swans.

Subfamily MERGINÆ. Mergansers.

Genus MERGANSER Brisson.

[B 611, R 636, C 743, U 129.]

Merganser americanus (Cass.). American Merganser. Rather common migrant, frequenting the larger water-courses.

[B 612, R 637, C 744, U 130.]

Merganser serrator (Linn.). Red-breasted Merganser. Rather rare in all portions of the State, but occasionally taken.

Genus LOPHODYTES Reichenbach.

[B 613, R 638, C 745, U 131.]

Lophodytes cucullatus (Linn.). Hooded Merganser. Spring and fall migrant; rather common. Doubtless breeds within the limits of the State.

Subfamily ANATINÆ. River Ducks.

Genus ANAS Linnæus.

[B 576, R 601, C 707, U 132.]

Anas boschas Linn. Mallard. Spring and fall migrant; very abundant. Arrives from the south about the middle of March, returning again the first of October and remaining until the first of December. Breeds in the northern part of the State.

[B 577, R 602, C 708, U 133.]

Anas obscura Gmel. Black Duck. Migratory; not common. Frequents the larger lakes and rivers, but seldom seen on the smaller streams. Mr. J. A. Allen, however, states that this species is "not uncommon along the rivers and in grassy ponds."

Subgenus CHAULELASMUS Bonaparte.

[B 584, R 604, C 711, U 135.]

Anas strepera Linn. Gadwall. Spring and fall migrant; rather common. Doubtless breeds in northern Iowa, inasmuch as the young have been taken at "the lakes" in August.

Subgenus MERECA Stephens.

[B 585, R 607, C 713, U 137.]

Anas americana Gmel. Baldpate. Migratory; common. Has not been observed during the summer.

Subgenus NETTION Kaup.

[B 579, R 612, C 715, U 139.]

Anas carolinensis Gmelin. Green-winged Teal. Abundant migrant. Breeds about the grassy marshes.

Subgenus QUERQUEDULA Stephens.

[B 581, R 609, C 716, U 140.]

Anas discors Linn. Blue-winged Teal. Abundant spring and fall migrant; and common summer resident, breeding in the "sloughs."

Genus SPATULA Boie.

[B 583, R 608, C 718, U 142.]

Spatula clypeata (Linn.). Shoveller. Migratory; rather common. Has not yet been observed breeding within the limits of the State.

Genus DAFILA Stephens.

[B 578, R 605, C 710, U 143.]

Dafila acuta (Linn.). Pintail. Spring and fall migrant; abundant. Appears the second week in March, and remains until the middle of April, returning again in October. Very large flocks are not unfrequently seen about the open ponds on the prairies.

Genus AIX Boie.

[B 587, R 613, C 719, U 144.]

Aix sponsa (Linn.). Wood Duck. Abundant migrant and rather common summer resident, especially in the northern part of the State where it frequents the wooded watercourses.

Genus AYTHYA Boie.

[B 591, R 618, C 723, U 146.]

Aythya americana (Eyt.). Red-head. Spring and fall migrant; abundant, though in some localities it does not appear to be common.

[B 592, R 617, C 724, U 147.]

Aythya vallisneria (Wils.). Canvas-back. Not as abundant as the last species, but rather common.

Subgenus FULIGULA Stephens.

[B 588, R 614, C 720, U 148.]

Aythya marila nearctica Stejn. American Scaup Duck. Migratory; not common.

[B 589, R 615, C 721, U 149.]

Aythya affinis (Eyt.). Lesser Scaup Duck. Migratory; rather common.

[B 590, R 616, C 722, U 150].

Aythya collaris (Donov.). Ring-necked Duck. Spring and fall migrant; abundant from the middle of March to the middle of April, and from the middle of October to the middle of November. Sometimes winters about the rapids in the streams, even in the northern part of the State.

Genus **GLAUCIONETTA** Stejneger.

[B 593, R 620, C 725, U 151.]

Glaucionetta clangula americana (Bonap.). American Golden-eye. Migrant; rare. During several years past only a few have been observed within the limits of the State.

Genus **CHARITONETTA** Stejneger.

[B 595, R 621, C 727, U 153.]

Charitonetta albeola (Linn.). Buffle-head. Spring and fall migrant; common.

Genus **ERISMATURA** Bonaparte.

[B 609, R 634, C 741, U 167.]

Erismatura rubida (Wils.). Ruddy Duck. Migratory, not very common.

Subfamily ANSERINÆ. Geese.

Genus **CHEN** Boie.

[B —, R 591 *a*, C 696, U 169.]

Chen hyperborea (Pall.). Lesser Snow Goose. Not uncommon during periods of migration.

Genus **ANSER** Brisson.

[B 565, 566, R 593 *a*, C 693, U 171 *a*.]

Anser albifrons gambeli (Hartl.). American White-fronted Goose. Abundant during both spring and fall migrations.

Genus **BRANTA** Scopoli.

[B 567, R 594, C 702, U 172.]

Branta canadensis (Linn.). Canada Goose. Migratory; common. Breeds in the vicinity of Spirit Lake and other localities in Northern Iowa.

[B 569, R 594 *a*, C 704, U 172 *a*.]

Branta canadensis hutchinsii (Sw. & Rich.). Hutchins' Goose. Migratory; not uncommon.

SUBFAMILY CYGNINÆ. SWANS.

GENUS **OLOR** WAGLER.

[B 561 *bis*, R 588, C 689, U 180.]

Olor columbianus (Ord.). Whistling Swan. Rare migrant.

[B 562, R 589, C 688, U 181.]

Olor buccinator (Rich.). Trumpeter Swan. Migratory; not common. Said to breed in the northwestern part of the State.

ORDER **HERODIONES.** HERONS, STORKS, IBISES, ETC.

SUBORDER HERODII. HERONS, EGRETS, BITTERNS, ETC.

FAMILY **ARDEIDÆ.** HERONS, BITTERNS, ETC.

SUBFAMILY BOTAURINÆ. BITTERNS.

GENUS **BOTAURUS** HERMANN.

SUBGENUS BOTAURUS.

[B 492, R 497, C 666, U 190.]

Botaurus lentiginosus (Montag.). American Bittern. Migratory; common in Southern and Central Iowa. Summer resident in the northern part of the State, where it breeds abundantly about the "lakes" and grassy marshes.

SUBGENUS ARDETTA GRAY.

[B 491, R 498, C 667, U 191.]

Botaurus exilis (Gmel.). Least Bittern. Common summer resident. Breeds in the "sloughs." The nest is a small platform of stems of plants woven among the growing stems of the Indian rice (*Zizania aquatica*), and placed about a foot above the water. Eggs four or five, laid about the last of May.

SUBFAMILY ARDEINÆ. HERONS AND EGRETS.

GENUS **ARDEA** LINNÆUS.

SUBGENUS ARDEA.

[B 487, R 487, C 655, U 194.]

Ardea herodias Linn. Great Blue Heron. Migratory; common. Breeds in the vicinity of Spirit Lake and other parts of Northern Iowa.

SUBGENUS HERODIAS BOIE.

[B 486, 486*, R 489, C 658, U 196.]

Ardea egretta Gmel. American Egret. Summer resident; rare. Observed along the borders of wooded streams.

Subgenus GARZETTA Kaup.

[B 485, R 490, C 659, U 197.]

Ardea candidissima Gmel. Snowy Heron. Very rare. Has been taken at Des Moines, and in Floyd County in August.

Subgenus FLORIDA Baird.

[B 490, R 493, C 662, U 200.]

Ardea cærulea Linn. Little Blue Heron. Rare. Observed only during the summer, in the eastern part of the State.

Subgenus BUTORIDES Blyth.

[B 493, R 494, C 663, U 201.]

Ardea virescens Linn. Green Heron. Common summer resident, arriving the last of April. Nests usually in small colonies among the willows in swampy localities. Often a single pair is found nesting a mile or two from water, and occasionally, also, in evergreens.

Genus **NYCTICORAX** Stephens.

Subgenus NYCTICORAX.

[B 495, R 495, C 664, U 202.]

Nycticorax nycticorax nævius (Bodd.). Black-crowned Night Heron. Summer resident; rather common in some localities.

Order **PALUDICOLÆ.** Cranes, Rails, Etc.

Suborder GRUES. Cranes.

Family **GRUIDÆ.** Cranes.

Genus **GRUS** Pallas.

[B 478, R 582, C 668, U 204.]

Grus americana (Linn.). Whooping Crane. Not uncommon during migrations. Occasionally breeds in the northern part of the State.

[B 479, R 583, C 670, U 206.]

Grus mexicana (Müll.). Sandhill Crane. Abundant migrant, arriving about the middle of March, and, on the return, again in October. Breeds on the prairies of northwestern Iowa.

Suborder RALLI. Rails, Gallinules, Coots, Etc.

Family **RALLIDÆ.** Rails, Gallinules, and Coots.

Subfamily RALLINÆ. Rails.

Genus **RALLUS** Linnæus.

[B 552, R 569, C 676, U 208.]

Rallus elegans Aud. King Rail. Not uncommon during migra-

tions. Breeds in the marshes near the larger lakes and in "sloughs." Unfledged young were found at Clear Lake late in August.

[B 554, R 572, C 677, U 212.]

Rallus virginianus Linn. Virginia Rail. Rather common during migrations. Breeds in grassy marshes.

GENUS **PORZANA** VIEILLOT.

SUBGENUS PORZANA.

[B 555, R 574, C 679, U 214.]

Porzana carolina (Linn.). Sora. Migratory; common. Arrives the last of April. Breeds in the sloughs of northern Iowa.

SUBGENUS COTURNICOPS BONAPARTE.

[B 557, R 575, C 680, U 215.]

Porzana noveboracensis (Gmel.). Yellow Rail. Occasionally observed during migrations. Frequents the prairie sloughs, where it perhaps breeds.

SUBFAMILY GALLINULINÆ. GALLINULES.

GENUS **GALLINULA** BRISSON.

[B 560, R 579, C 685, U 219.]

Gallinula galeata (Licht.). Florida Gallinule. Common summer resident, breeding the last of May in the marshes of Indian rice (*Zizania aquatica*), and rushes (*Scirpus validus*). The nest is usually placed upon broken-down stems just above the water or often resting in the water, and is composed chiefly of rush stems. Eggs eight to fourteen.

SUBFAMILY FULICINÆ. COOTS.

GENUS **FULICA** LINNÆUS.

[B 559, R 580, C 686, U 221.]

Fulica americana Gmel. American Coot. Abundant during migrations. Breeds.

ORDER **LIMICOLÆ.** SHORE BIRDS.

FAMILY **PHALAROPODIDÆ.** PHALAROPES.

GENUS **PHALAROPUS** BRISSON.

SUBGENUS STEGANOPUS VIEILLOT.

[B 519, R 565, C 602, U 224.]

Phalaropus tricolor (Vieillot.). Wilson's Phalarope. Common during migrations in some localities; rarely seen in others. Breeds in the grassy prairie marshes.

FAMILY SCOLOPACIDÆ. SNIPES, SANDPIPERS, ETC.

GENUS PHILOHELA GRAY.

[B 522, R 525, C 606, U 228.]

Philohela minor (Gmel.). American Woodcock. Summer resident; not uncommon in the woodlands bordering the water-courses.

GENUS GALLINAGO LEACH.

[B 523, R 526 *a*, C 608, U 230.]

Gallinago delicata (Ord.). Wilson's Snipe. Spring and fall migrant; abundant.

GENUS MACRORHAMPHUS LEACH.

[B 524, R 527, C 609, U 231.]

Macrorhamphus griseus (Gmel.). Dowitcher. Not uncommon during the migratory periods.

GENUS MICROPALAMA BAIRD.

[B 536, R 528, C 611, U 233.]

Micropalama himantopus (Bonap.). Stilt Sandpiper. Migratory; very rare. Observed but once, and that in early autumn on the open prairie in Floyd County. There were four individuals wading about in a small pond; a single specimen only was secured.

GENUS TRINGA LINNÆUS.

SUBGENUS ACTODROMAS KAUP.

[B 531, R 534, C 616, U 239.]

Tringa maculata Vieill. Pectoral Sandpiper. Migratory; abundant. Frequents the prairie ponds.

[B 533, R 536, C 617, U 240.]

Tringa fuscicollis Vieill. White-rumped Sandpiper. Rather common migrant, appearing the last of March about the quiet pools near the water-courses.

[B 532, R 538, C 614, U 242.]

Tringa minutilla Vieill. Least Sandpiper. Migratory; abundant. Observed at Fairfield, July 13, 1886; there were several of this species feeding on the borders of the reservoir of the water-works, just north of the town.

GENUS EREUNETES ILLIGER.

[B 535, R 541, C 612, U 246.]

Ereunetes pusillus (Linn.). Semipalmated Sandpiper. Spring and fall migrant; rather common.

GENUS CALIDRIS CUVIER.

[B 534, R 542, C 627, U 248.]

Calidris arenaria (Linn.). Sanderling. Not common. Occurs during migrations about the lakes of Northern Iowa.

GENUS **LIMOSA** BRISSON.

[B 547, R 543, C 628, U 249.]

Limosa fedoa (Linn.). Marbled Godwit. Not very common. Frequents prairie ponds during migratory periods.

GENUS **TOTANUS** BECHSTEIN.

SUBGENUS GLOTTIS KOCH.

[B 539, R 548, C 633, U 254.]

Totanus melanoleucus (Gmel.). Greater Yellow-legs. Migratory; common during April and September, feeding in small companies on low, wet flats adjacent to water-courses.

[B 540, R 549, C 634, U 255.]

Totanus flavipes (Gmel.). Yellow-legs. Migratory; common. Frequents the bayous along the rivers, and the muddy borders of prairie ponds.

SUBGENUS RHYACOPHILUS KAUP.

[B 541, R 550, C 637, U 256.]

Totanus solitarius (Wils.). Solitary Sandpiper. Migratory; common. Arrives the middle of April, frequenting the secluded pools in marshy woodlands. Doubtless breeds in the State, but thus far its eggs have not been discovered within its limits.

GENUS **SYMPHEMIA** RAFINESQUE.

[B 537, R 552, C 632, U 258.]

Symphemia semipalmata (Gmel.). Willet. Migratory; not uncommon about the sloughs.

GENUS **BARTRAMIA** LESSON.

[B 545, R 555, C 640, U 261.]

Bartramia longicauda (Bechst.). Bartramian Sandpiper. Summer resident; abundant; frequenting the prairies. Arrives the middle of April. Nidification commences about the middle of May. During the nesting season it is the most solicitous of birds. So fearless is it, at times, that it may be killed with a walking-stick or struck with a whip as it rests upon posts along the roadside.

GENUS **ACTITIS** ILLIGER.

[B 543, R 557, C 638, U 263.]

Actitis macularia (Linn.). Spotted Sandpiper. Common summer resident, arriving the middle of April. Nests on the sand-bars along the streams.

GENUS **NUMENIUS** BRISSON.

[B 549, R 558, C 643, U 264.]

Numenius longirostris Wils. Long-billed Curlew. Migratory; rather common. A few remain during the summer and nest on the open prairies.

FAMILY **CHARADRIIDÆ.** PLOVERS.

GENUS **CHARADRIUS** LINNÆUS.

SUBGENUS SQUATAROLA CUVIER.

[B 510, R 513, C 580, U 270.]

Charadrius squatarola (Linn.). Black-bellied Plover. Spring and fall migrant; rare.

SUBGENUS CHARADRIUS LINNÆUS.

[B 503, R 515, C 581, U 272.]

Charadrius dominicus Müll. American Golden Plover. Spring and fall migrant; abundant. Arrives the first week in April. Has been taken at Des Moines as late as June 6.

GENUS **ÆGIALITIS** BOIE.

SUBGENUS OXYECHUS REICHENBACH.

[B 504, R 516, C 584, U 273.]

Ægialitis vocifera (Linn.). Killdeer. Abundant migrant and common summer resident. Arrives the middle of March.

ORDER **GALLINÆ.** GALLINACEOUS BIRDS.

SUBORDER PHASIANI. PHEASANTS, GROUSE, PARTRIDGES, QUAILS, ETC.

FAMILY **TETRAONIDÆ.** GROUSE, PARTRIDGES, ETC.

SUBFAMILY PERDICINÆ. PARTRIDGES.

GENUS **COLINUS** LESSON.

[B 471, R 480, C 571, U 289.]

Colinus virginianus (Linn.). Bob-white. Common resident; formerly more abundant than now. During the winter many farmers care for them, the quails coming regularly, like chickens, morning and evening to be fed. During the fall flocks of these birds frequently come into the towns, especially where there are many evergreens, and pass the night. The nest is placed often in open woodland or meadows. Eggs number from twelve to twenty in a single nest.

SUBFAMILY TETRAONINÆ. GROUSE.

GENUS **BONASA** STEPHENS.

[B 465, R 473, C 565, U 300.]

Bonasa umbellus (Linn.). Ruffed Grouse. Resident; common in some localities, rare in others. In the vicinity of Iowa City, and the eastern portion of the State generally, it appears to be quite common in the woodlands where it is found breeding. At Des Moines and in some other localities it is seldom seen.

GENUS TYMPANUCHUS GLOGER.

[B 464, R 477, C 563, U 305.]

Tympanucus americanus (Reich.). Prairie Hen. Resident; abundant, though usually noticed more frequently during the fall and winter than at other seasons of the year. Wanders about in large flocks through the fields in search of food. It is reported that large numbers are killed by flying against the telegraph wires and barbed-wire fences. Instances of the latter, especially, have come under the observer's notice, as well as many similar ones among the smaller birds.

GENUS PEDIOCÆTES BAIRD.

[B , R , C , U 305 *b*.]

Pediocætes phasianellus campestris Ridgw. Prairie Sharp-tailed Grouse. Common on the prairies of northwestern Iowa.

FAMILY PHASIANIDÆ. PHEASANTS, ETC.

SUBFAMILY MELEAGRINÆ. TURKEYS.

GENUS MELEAGRIS LINNÆUS.

[B 457, R 470 *a*, C 554, U 310.]

Meleagris gallopavo Linn. Wild Turkey. Resident; formerly very abundant, but becoming less common each year. A few are occasionally taken in the heavily timbered districts along the streams.

ORDER COLUMBÆ. PIGEONS.

FAMILY COLUMBIDÆ. PIGEONS.

GENUS ECTOPISTES SWAINSON.

[B 448, R 459, C 543, U 315.]

Ectopistes migratorius (Linn.). Passenger Pigeon. Large flocks occasionally appear in different parts of the State. A few are usually seen each spring, and a few pairs sometimes breed within the limits of the State. A nest with one egg was taken at Charles City, June 14, 1879.

GENUS ZENAIDURA BONAPARTE.

[B 451, R 460, C 544, U 316.]

Zenaidura macroura (Linn.). Mourning Dove. Common summer resident from the first week in April until November. Nidification usually commences by the last of April. Although this species generally builds its nest in a tree, several nests have been found on the ground and on low stumps. One instance was presented in which the nest with eggs was found on plowed ground in a corn-field.

Order **RAPTORES.** Birds of Prey.

Suborder SARCORHAMPHI. American Vultures.

Family **CATHARTIDÆ.** American Vultures.

Genus **CATHARTES** Illiger.

[B 1, R 454, C 537, U 325.]

Cathartes aura (Linn.). Turkey Vulture. Common summer resident, arriving early in April and remaining until November. At Van Meter, in Dallas County, a dozen or more, in company with crows, were noticed on a sand-bar in the Racoon River, feeding upon dead mussels. The water in the river had been quite high for some time, and had fallen rather suddenly, leaving thousands of mussels stranded on the bar, where they had died and were decaying.

Suborder FALCONES. Vultures, Falcons, Hawks, Buzzards, Eagles, Kites, Harriers, Etc.

Family **FALCONIDÆ.** Vultures, Falcons, Hawks, Eagles, Etc.

Subfamily ACCIPITRINÆ. Kites, Buzzards, Hawks, Goshawks, Eagles, Etc.

Genus **ELANOIDES** Vieillot.

[B 34, R 426, C 493, U 327.]

Elanoides forficatus (Linn.). Swallow-tailed Kite. Summer resident; common in some localities, rare in others. Arrives in April and departs in September.

Genus **CIRCUS** Lacepede

[B 38, R 430, C 489, U 331.]

Circus hudsonius (Linn.). Marsh Hawk. Resident; abundant in some localities, rare in others. In early autumn, large flocks are not unfrequently seen flying over the prairies.

Genus **ACCIPITER** Brisson.

Subgenus ACCIPITER.

[B 17, R 432, C 494, U 332.]

Accipiter velox (Wils.). Sharp-shinned Hawk. Very common during migratory periods, but not noticed often during the summer.

[B 15, 16, R 431, C 495, U 333.]

Accipiter cooperi (Bonap.). Cooper's Hawk. Summer resident; rather common. Arrives about the first of April, and remains until October. All nests examined contained no lining whatever—a few small pieces of bark only being in the center of the depression of the nest. Eggs usually number four or five, laid the last of April.

SUBGENUS ASTUR LACEPEDE.

[B 14, R 433, C 496, U 334.]

Accipiter atricapillus (Wils.). American Goshawk. Rare; observed only during the winter.

GENUS **BUTEO** CUVIER.

[B 23, R 436, C 516, U 337.]

Buteo borealis (Gmel.) Red-tailed Hawk. Resident; common. The nest is commonly placed near the top of the highest tree in the forest, and is often visible more than a mile away. The eggs are laid late in March, and are usually two or three — rarely four — in number.

[B 25, R 439, C 520, U 339.]

Buteo lineatus (Gmel.). Red-shouldered Hawk. Rather common resident in some localities; rare in others.

[B 18, 19, 22, 28, R 442, C 523, U 342.]

Buteo swainsoni Bonap. Swainson's Hawk. Rather common; breeds in central Iowa, and probably in other parts of the State.

[B 27, R 443, C 524, U 343.]

Buteo latissimus (Wils.) Broad-winged Hawk. Not uncommon from April to October. In the proceedings of the United States National Museum, Vol. IX., Mr. Ridgway gives a very interesting description of a melanistic specimen of this species taken at Crystal Lake in Hancock County.

GENUS **ARCHIBUTEO** BREHM.

[B 30, 31, R 447, C 525, U 347 *a*.]

Archibuteo lagopus sancti-johannis (Gmel.) American Rough-legged Hawk. Not uncommon; usually noticed from October to March, in the fields and more open woodland.

GENUS **AQUILA** BRISSON.

[B 39, R 449, C 532, U 349.]

Aquila chrysaetos (Linn.). Golden Eagle. Rare; a fine specimen of this species was shot near Des Moines several years ago. Several were taken in the eastern part of the State last year (1886).

GENUS **HALIÆETUS** SAVIGNY.

[B 41, 43, R 451, C 534, U 352.]

Haliæetus leucocephalus (Linn.). Bald Eagle. Rare. Young have been taken at various times, and kept in confinement for two or three years.

SUBFAMILY FALCONIDÆ. FALCONS.

GENUS **FALCO** LINNÆUS.

SUBGENUS ÆSOLON KAUP.

[B 7, R 417, C 505, U 357.]

Falco columbarius Linn. Pigeon Hawk. Usually noticed during the spring and fall migrations. Not common.

SUBGENUS TINNUNCULUS VIEILLOT.

[B 13, R 420, 420 *a*, C 508, 509, U 360.]

Falco sparverius Linn. American Sparrow-hawk. Summer resident; common from March until October. Nests in cavities in trees. Commonly met with along country roads, where it perches upon telegraph poles and dead trees. It is not uncommon to see half a dozen or more of these birds at one time, hovering over a field, and ever and anon darting down to seize some unfortunate field-mouse, grasshopper, or reptile.

SUBFAMILY PANDIONINÆ. OSPREYS.

GENUS **PANDION**. SAVIGNY.

[B 44, R 425, C 530, U 364.]

Pandion haliaetus carolinensis (Gmel.) American Osprey. Rare summer resident. This bird is occasionally shot on the Des Moines River a few miles above Des Moines city.

SUBORDER STRIGES. OWLS.

FAMILY **STRIGIDÆ**. BARN OWLS.

GENUS **STRIX** LINNÆUS.

[B 47, R 394, C 461, U 365.]

Strix pratincola Bonap. American Barn Owl. Rare. Very seldom seen in central Iowa.

FAMILY **BUBONIDÆ**. HORNED OWLS.

GENUS **ASIO** BRISSON.

[B 51, R 395, C 472, U 366.]

Asio wilsonianus (Less.). American Long-eared owl. Resident; apparently not as common as some of the other species of Iowa *Bubonidæ*. This may be due, in part, to its nocturnal habits, though it is not unfrequently met with in its favorite haunts—the dark shady woodland covering the bluffs. It commences to breed about the second week in April, and usually appropriates some abandoned nest of a

hawk or crow. A nest found on April 15, 1882, was situated in a small tree in a deep ravine, and was supported only by a few small twigs, at a height of about twenty feet; it contained five slightly incubated eggs. The female was on the nest when discovered, but quietly glided away when the tree was struck with a stick. On the 29th of the same month, two more nests were discovered, and a few days later, another. The first of these three nests was placed about fifteen feet from the ground, in the top of a small oak, and contained three fresh eggs. The second nest contained four newly-hatched young and two eggs nearly incubated; there were, within thirty yards of this nest, a crow's nest with young, and a nest of Cooper's hawk with three eggs. The manœuvers of the parent owls were quite comical. When the ascent to the nest commenced both birds tumbled to the ground feigning injury, and began a series of very plaintive notes, somewhat similar to the whining of young kittens; at the same time their wings were expanded around the body, and a furious snapping of the beaks indulged in — a characteristic exhibited by the young of both this species, the great horned and other owls, even before they leave the nest. The nest found May 3d, contained four young, nearly fledged. A week later, all with the exception of one had left the nest. A number of nests of this species examined recently each contained five eggs, which would seem to be the usual number.

At Charles City, a long-eared owl was picked up on the prairie, several miles from any woods; it was not injured, yet allowed itself to be taken with the hand.

[B 52, R 396, C 473, U 367.]

Asio accipitrinus (Pall.). Short-eared Owl. Resident; rather common. Usually noticed flying over fields and marshy meadows in search of food. During the winter they often resort to woodland. Nests in May on open prairie.

Genus SYRNIUM Savigny.

[B 54, R 397, C 476, U 368.]

Syrnium nebulosum (Forst.). Barred Owl. Resident; common. Frequents the heavy timber along the streams; nesting commences about the middle of April.

Genus NYCTALA Brehm.

[B 56, 57, R 401, C 483, U 372.]

Nyctala acadica (Gmel.). Saw-whet Owl. Not common. Taken occasionally in the autumn.

GENUS **MEGASCOPS** KAUP.

[B 49, *part*, R 402, C 465, U 373.]

Megascops asio (Linn.). Screech Owl. Resident; common. Perhaps the most familiar of our owls. The eggs are laid in April.

GENUS **BUBO** CUVIER.

[B 48, R 405, C 462, U 375.]

Bubo virginianus (Gmel.). Great Horned Owl. Resident; common in the heavy timber bordering the streams. The eggs are laid about the middle of February, and are usually two in number. Of eight nests taken in the immediate vicinity of Des Moines, all contained two eggs each, except one, which contained three. The young are fledged by the first of May. The nest is usually a shallow depression in the bottom of a cavity of some tree; or sometimes an abandoned hawk's nest is selected. An instance of the former nesting-site was presented February 17, 1883, near Des Moines, the place selected being a large sycamore tree. The cavity was about three feet in diameter, and of about the same depth. There were three entrances, a small and narrow one at the top, and two circular ones at the side, the depression containing the eggs being near one of these lateral openings. The bottom of the cavity consisted of decayed wood, which was nearly hidden by snow. Scattered around were a dozen or more tail feathers of the owls; the skull, several bones and bits of fur of a rabbit; the leg of some large raptorial bird, and the remains of several smaller birds besides a recently-captured pigeon.

The great horned owl occupies the same nest year after year, and even if the nest be disturbed and the first set of eggs taken, often deposits a second set in the same nest. A pair of young, just about to leave the nest was taken on May 2, 1882, and kept for three years confined in a barn. About the middle of June the "horns" began to appear, and in three or four weeks were quite conspicuous. These birds were fed on fresh beef and rats — the latter they usually captured.

[B 48, *part*, R 405 *a*, *part*, C 463, *part*, U 375 *a*.]

Bubo virginianus subarcticus (Hoy). Western Horned Owl. Rather rare. Occasionally taken in the northern part of the State.

GENUS **NYCTEA** STEPHENS

[B 61, R 406, C 479, U 376.]

Nyctea nyctea (Linn.). Snowy Owl. Rather rare winter visitant in central and southern Iowa; more common in the northern part of the State, where it is found only on the prairies.

ORDER PSITTACI. PARROTS, MACAWS, PAROQUETS, ETC.

FAMILY PSITTACIDÆ.

GENUS CONURUS KUHL.

[B 63, R 392, C 460, U 382.]

Conurus carolinensis (Linn.). Carolina Paroquet. Formerly occurred in the southern part of the State, but has not been observed recently. Mr. Tripp gives it as having occured in Decatur County, but it must now be excluded from Iowa's *avi-fauna.*

ORDER COCCYGES. CUCKOOS, ETC.

SUBORDER CUCULI. CUCKOOS.

FAMILY CUCULIDÆ. CUCKOOS, ANIS, ETC.

SUBFAMILY COCCYGINÆ. AMERICAN CUCKOOS.

GENUS COCCYZUS VIEILLOT.

[B 69, R 387, C 429, U 387.]

Coccyzus americanus (Linn.). Yellow-billed Cuckoo. Summer resident; rather common, arriving the first week in May, and remaining until the first of October. Nidification commences about the middle of June, though fresh eggs have been taken as late as the second week in August. It is not uncommon to find a nest that contains a half-fledged young bird, a bird just hatched, a half-incubated egg, and perhaps, also, a fresh egg.

[B 70, R 388, C 428, U 388.]

Coccyzus erythrophthalmus (Wils.). Black-billed Cuckoo. Summer resident; not as common as *C. americanus.* Usually nests in bushes in damp woodland, and, like the last species, lays its eggs at irregular intervals.

SUBORDER ALCYONES. KINGFISHERS.

FAMILY ALCEDINIDÆ. KINGFISHERS.

GENUS CERYLE BOIE.

SUBGENUS STREPTOCERYLE BONAPARTE.

[B 117, R 382, C 423, U 390.]

Ceryle alcyon (Linn.). Belted Kingfisher. Summer resident; common from March to November. Its eggs are usually laid the last week in May.

Order PICI. Woodpeckers, Wrynecks, Etc.

Family PICIDÆ. Woodpeckers.

Genus DRYOBATES Boie.

[B 74, *part*, R 360, C 438, *part*, U 393.]

Dryobates villosus (Linn.). Hairy Woodpecker. Resident; rather common. The eggs are laid about the last of April. In the winter this bird has been observed feeding upon fresh beef, which it picked from bones brought into the yard by dogs.

[B 76, R 361, C 440, U 394.]

Dryobates pubescens (Linn.). Downy Woodpecker. Resident; common. "This is the little spotted woodpecker that bores the apple trees so persistently, but it does not appear to hurt them. In declaring war against woodpeckers, the agriculturist will do well to discriminate between the somewhat injurious and the highly beneficial species." *(Coues).*

Genus SPHYRAPICUS Baird.

[B 85, R 369, C 446, U 402.]

Sphyrapicus varius (Linn.). Yellow-bellied Sapsucker. Summer resident; rather common, arriving the second week in April. This species excavates its nest in the limb of some tree in the heavy timber along the water-courses. Nidification commences usually about the last of May. A number of nests have been examined near Des Moines; one of these was not more than ten feet from the ground, while another was over seventy-five feet. The latter was built in the living wood of an elm, and was carefully watched from the time the nest was begun until it was finished.

Genus CEOPHLŒUS Cabanis.

[B 90, R 371, C 432, U 405.]

Ceophlœus pileatus (Linn.). Pileated Woodpecker. Resident; not uncommon in the heavy timber along the watercourses; rare in other localities. It is becoming more and more rare each year, and will soon disappear with the heavy forest tracts.

Genus MELANERPES Swainson.

Subgenus MELANERPES.

[B 94, R 375, C 453, U 406.]

Melanerpes erythrocephalus (Linn.). Red-headed Woodpecker. Summer resident; quite common. Arrives about the first of May and remains until the middle of September. Breeds the first week in June. Occasionally winters. One was seen one cold day in January, at Des Moines. At Iowa City a pair was noticed on the University campus nearly every day during the winters of 1885–86, and 1886–87.

Subgenus CENTURUS Swainson.

[B 91, R 372, C 450, U 409.]

Melanerpes carolinus (Linn.). Red-bellied Woodpecker. Resident; rather common. Seen most abundantly in the spring and fall.

Genus **COLAPTES** Swainson.

[B 97, R 378, C 457, U 412.]

Colaptes auratus (Linn.). Flicker. Resident; abundant. During the season of 1880 more than fifty eggs were taken from the nest of one pair of birds.

Order **MACROCHIRES.** Goatsuckers, Swifts, Etc.

Suborder CAPRIMULGI. Goatsuckers, Etc.

Family **CAPRIMULGIDÆ.** Goatsuckers, Etc.

Genus **ANTROSTOMUS** Gould.

[B 112, R 354, C 397, U 417.]

Antrostomus vociferus (Wils.). Whip-poor-will. Summer resident; common in woodland, where it lays its eggs on the ground, among dry leaves.

Genus **CHORDEILES** Swainson.

[B 114, R 357, C 399, U 420.]

Chordeiles virginianus (Gmel.). Night-hawk. Summer resident; abundant from the first week in May until the first of October. In the cities the eggs are laid on the gravel roofs of buildings. Usually about the middle of September immense numbers pass southward in scattered flocks — hundreds of birds being in sight at once.

Suborder CYPSELI. Swifts.

Family **MICROPODIDÆ.** Swifts.

Subfamily CHÆTURINÆ. Spine-tailed Swifts.

Genus **CHÆTURA** Stephens.

[B 109, R 351, C 405, U 423.]

Chætura pelagica (Linn.). Chimney Swift. Summer resident; abundant from the third week in April until the middle of September. Breeds about the tenth of June. In towns it is most abundant, and nests in chimneys — some of the large factory chimneys being occupied by hundreds. In other portions of the State, hollow trees are often taken for nesting sites.

Suborder TROCHILI. Humming-birds.

Family TROCHILIDÆ. Humming-birds.

Genus TROCHILUS Linnæus.

[B 101, R 335, C 409, U 428.]

Trochilus colubris Linn. Summer resident; common from the second week in May until the last of September. In July, 1881, one of these birds was captured and confined in a room for more than a week. Every day during that time it was offered sugar dissolved in water, of which it appeared quite fond.

Order PASSERES. Perching Birds.

Suborder CLAMATORES. Songless Perching Birds.

Family TYRANNIDÆ. Tyrant Flycatchers.

Genus TYRANNUS Cuvier.

[B 124, R 304, C 368, U 444.]

Tyrannus tyrannus (Linn.). Kingbird. Summer resident; common from the last week in April to the third week in September. There is a general impression prevailing among agriculturists that this species captures and destroys many honey-bees, but "it destroys a thousand noxious insects for every bee it eats." *(Coues).* Nests in orchards and swampy woodland.

[B 126, R 306, C 370, U 447.]

Tyrannus verticalis Say. Arkansas Kingbird. No personal observation has been made on this species in Iowa. Mr. Allen, in his notes on the birds of western Iowa, states that "at Boonesboro a pair of large flycatchers were seen in the timber, which I scarcely doubt were of this species. Having no gun with me at the time, I was unable to get them, and did not meet with them elsewhere."

Genus MYIARCHUS Cabanis.

[B 130, R 312, C 373, U 452.]

Myiarchus crinitus (Linn.). Crested Flycatcher. Summer resident; common from the first of May to the third week in September. Nests in bird-boxes and cavities in trees.

Genus SAYORNIS Bonaparte.

[B 135, R 315, C 379, U 456.]

Sayornis phœbe (Lath.). Phœbe. Summer resident; abundant. Arrives the third week in March, and commences nesting about the middle of April. The nest is placed under bridges, sheds, overhanging

rocks, and similar sites. The eggs of this species are usually recorded as pure *white* and *unmarked*. From the personal examination of nearly two hundred nests, it would seem that at least one-fourth of the eggs were marked with reddish-brown spots. The occurrence of spots upon eggs normally without markings is not unfrequently noticed among the eggs of the common barn-yard fowl; and it is also recorded of the robin and other species.

GENUS **CONTOPUS** CABANIS.

[B 137, R 318, C 380, U 459.]

Contopus borealis (Swains.). Olive-sided Flycatcher. Rare; observed only in the spring.

[B 139, R 320, C 382, U 461.]

Contopus virens (Linn.). Wood Pewee. Summer resident; common from the 10th of May until September. Its note may be heard at almost any time after its arrival, in the woodland along the streams.

GENUS **EMPIDONAX** CABANIS.

[B 144, R 322, C 388, U 463.]

Empidonax flaviventris Baird. Yellow-bellied Flycatcher. Migratory; not common. Appears the first week in May.

[B 143, R 324, C 384, U 465.]

Empidonax acadicus (Gmel.). Acadian Flycatcher. Summer resident; not common. Several nests have been taken near Des Moines during the past few years. One found May 26, 1881, was composed of dry grasses, catkins, and spider-webs, and was pendant. It was attached to the forks of a small horizontal branch, about seven feet from the ground.

[B 140, R 325 *a*, C 385, U 466 *a*.]

Empidonax pusillus traillii (Aud.). Traill's Flycatcher. Migratory; common. Appears the second week in May, frequenting the willows along the streams. Breeds in the northern portions of the State.

[B 142, R 326, C 387, U 467.]

Empidonax minimus Baird. Least Flycatcher. Migratory; common. Arrives the first week in May. Breeds "in large numbers in Mahaska County." (*Tripp.*)

SUBORDER **OSCINES.** SONG BIRDS.

FAMILY **ALAUDIDÆ.** LARKS.

GENUS **OTOCORIS** BONAPARTE.

[B 302, R 300, C 82, U 474.]

Otocoris alpestris (Linn.). Horned Lark. Winter visitant; not uncommon in eastern Iowa.

[B —, R —, C —, U 474 *b*.]

Otocoris alpestris praticola Hensh. Prairie Horned Lark. Resident; common. Breeds in the open fields and prairies. The eggs are laid late in March, even before the snow has melted. Two broods are usually raised in a season.

Family CORVIDÆ. Crows, Jays, Magpies, Etc.

Subfamily GARRULINÆ. Magpies and Jays.

Genus CYANOCITTA Strickland.

[B 434, R 289, C 349, U 477.]

Cyanocitta cristata (Linn.). Blue Jay. Resident; abundant. Notorious for its thievish propensities. The writer has seen the larger part of a bushel of hazel nuts disappear from a shed-roof in a very short time — all carried away by the jays. During the spring and fall large flocks of these birds — often three or four hundred in number — have been observed flying northward and southward, with every indication that they were migrating. In nest-building, this species has been observed to procure materials by breaking off with its beak the dead twigs of a tree in the proximity of the one in which the half-completed nest was situated.

Subfamily CORVINÆ. Crows.

Genus CORVUS Linnæus.

[B 426, R 282, C 340, U 488.]

Corvus americanus Aud. American Crow. Resident; abundant. The eggs are laid about the first of April. The young taken from the nest form very interesting pets.

Family ICTERIDÆ. Blackbirds, Orioles, Etc.

Genus DOLICHONYX Swainson.

[B 399, R 257, C 312, U 494.]

Dolichonyx oryzivorus (Linn.). Bobolink. Summer resident; common throughout central and northern Iowa. Arrives about the first of May.

Genus MOLOTHRUS Swainson.

[B 400, R 258, C 313, U 495.]

Molothrus ater (Bodd.). Cowbird. Summer resident; abundant. Arrives from the middle of March to April, and remains until October. "Gregarious, polygamous, parasitic." (*Coues.*) Before the smaller species of birds have commenced to build their nests, many of the females of *M. ater* are compelled to deposit their eggs in the nests of

some of the larger species: brown thrasher, chewink, rose-breasted grosbeak, blue bird, bronzed grackle, etc. As many as six eggs of *M. ater* have been taken at one time from the nest of a wood thrush.

GENUS **XANTHOCEPHALUS** BONAPARTE.

[B 404, R 260, C 319, U 497.]

Xanthocephalus xanthocephalus (Bonap.). Yellow-headed Blackbird. Summer resident; not common in the eastern portion of the State; abundant in central and northern portions. Arrives the third week in April, and commences breeding about a month later. Ample opportunity for studying the breeding habits of this species is afforded by a large prairie marsh a few miles from Des Moines. A colony of several hundred of these birds has occupied this marsh for a number of seasons past. Long before a single bird is seen the harsh, unpleasant chorus, issuing from the middle of the marsh and heard amidst the notes of thousands of red-wings, proclaims the arrival of the yellow-head. Nidification begins three or four weeks later. The nest is a large, bulky structure, composed chiefly of the dry leaves and small stems of Indian rice *(Zizania aquatica)*, and lined with the tops of the same plant; it is loosely woven around the standing rice stems, or often around the growing stems of the bulrush *(Scirpus validus)*, and is placed three or four feet above the water. The eggs are four or five in number, often only three, and occcasionally six.

GENUS **AGELAIUS** VIEILLOT.

[B 401, R 261, C 316, U 498.]

Agelaius phœniceus (Linn.). Red-winged Blackbird. Summer resident; abundant. Arrives about the middle of March and departs about the middle of November. Its arrival is heralded by the appearance of a few males, in company with the rusty blackbirds; a few days later large flocks arrive. In the fall it associates promiscuously with the rusty blackbird and bronzed grackle, together forming flocks of many thousands, which wander about in woodland and corn-fields until the departure for the south. The nest is usually placed in a tuft of sedges a few inches above the water in a marsh; but often situated ten or fifteen feet from the ground, in willows bordering the streams. This species has been taken at Charles City, in December.

GENUS **STURNELLA** VIEILLOT.

[B 406, R 263, C 320, U 501.]

Sturnella magna (Linn.). Meadow-lark. Summer resident; abundant, arriving the middle of March.

[B 407, R 264, C 322, U 501 *b*.]

Sturnella magna neglecta (Aud.). Western Meadow-lark. Mr. Tripp notices it from southern Iowa. In Floyd County it is more common than *S. magna*, and frequents the outskirts of the towns, while *S. magna* is usually found on the prairies.

Genus **ICTERUS** Brisson

Subgenus PENDULINUS Vieillot.

[B 414, R 270, C 324, U 506.]

Icterus spurius (Linn.). Orchard Oriole. Summer resident; common. Arrives the first week in May and remains until September. Nests in orchards and open woodland.

Subgenus YPHANTES Vieillot.

[B 415, R 271, C 326, U 507.]

Icterus galbula (Linn.). Baltimore Oriole. Summer resident; common from the first of May until September. Its pensile nest is usually attached to the twigs of a drooping branch of some tree. On one occasion bits of twine and strips of colored cloth were placed in the grass near a tree in which a pair of orioles were building a nest, and in the course of a few days we were in possession of a very interesting specimen of avian architecture, gay with many colors.

Genus **SCOLECOPHAGUS** Swainson.

[B 417, R 273, C 331, U 509.]

Scolecophagus carolinus (Müll.). Rusty Blackbird. Spring and fall migrant; abundant from the middle of March to the middle of May, and from the middle of October to the middle of November. In woodland when alarmed a whole flock, numbering several hundred, will fly to the top of some tall tree and begin a loud, harsh vocalization, which may be heard for a great distance.

Genus **QUISCALUS** Vieillot.

Subgenus QUISCALUS.

[B —, R 278 *b*, C 337, U 511 *b*.]

Quiscalus quiscula æneus (Ridgw.). Bronzed Grackle. Summer resident; abundant from the middle of March to the middle of November. In the spring it is not an uncommon sight to see a score or more of these birds following the plow and devouring the grubs and insects that are upturned. In the fall it mingles with the rusty and red-winged blackbirds, frequenting the corn-fields in large flocks.

"The autumnal migrations of *Icteridæ* at Burlington, Iowa, are notable chiefly on account of the immense flocks of certain blackbirds which

congregate in that vicinity. The extensive swamps bordering the Mississippi River above and below the city, on the Illinois side, form an especially favorable rendezvous for these birds, three species of which are represented nearly in equal numbers — *Quiscalus quiscula æneus*, *Scolecophagus carolinus*, and *Agelaius phœniceus*. During September and October, the corn-fields of Iowa are visited by countless numbers of these black marauders, which wander about in mixed flocks of several thousands, passing the day in the fields, and the nights in the woodland or marshes. And it is during this period that so many thousands are poisoned and killed by the farmers. About the first of October, these birds begin to appear from the more northern districts, pouring into the Burlington swamps in myriads, and by the middle of the month immense numbers have here collected. Just before sunrise vast flocks begin to rise out of the swamps and radiate in all directions towards the inland corn-fields, where they spend the day, returning again to the swamps before sunset. These flocks are often a quarter of a mile in width, and are more than an hour in passing — a great, black band slowly writhing like some mighty serpent across the heavens, in either direction its extremities lost to view in the dim and distant horizon. Not unfrequently three or four such vast flocks are in sight at one time. How far away from their night retreats they wander each day has not been observed; an hour and a half before sunset, twelve miles away from the river, the mighty armies of blackbirds are still seen coming over distant hills and directing their courses toward the marshes. It is evident, however, that many miles are daily traversed in their journeys to and from their feeding grounds. Making liberal deductions for any possibility of over-estimating, the numerical minimum of individuals in a single flock cannot be far from twenty millions."*

Family FRINGILLIDÆ. Finches, Sparrows, Etc.

Genus COCCOTHRAUSTES Brisson.

Subgenus HESPERIPHONA Bonaparte.

[B 303, R 165, C 189, U 514.]

Coccothraustes vespertina (Coop.). Evening Grosbeak. Winter visitant; rare, and rather erratic, though its appearance is more regular in the northern than in other portions of the State. It arrives from the north about the last of November, and remains until May. A flock of these birds spent the winter of 1886–7 in the vicinity of Iowa City, and chiefly around the State University. The movements of a flock of more than one hundred individuals which livened the campus for nearly ten weeks, were watched with deep interest. During its

* Blackbird Flights at Burlington, Iowa.— Charles R. Keyes. The Auk, Vol. V., p. 207.

sojourn, twenty fine specimens were secured, several of which were dissected for the purpose of further determining the nature of the food of this interesting species. "About the middle of December several were observed a short distance north of the city, but it was not until the first of February that they began to court the society of man and appear in the principal streets. When first noticed in the town, there was a flock of twenty-five or thirty feeding upon the *samaræ*, or key-fruits, which were still attached to the branches of the box-elders. The kernels of the keys were quickly and adroitly removed, and the refuse allowed to fall upon the snow beneath, which, after a short time, was thickly strewn with the remains of the feast. On the 23d of February, a flock of over one hundred suddenly appeared on the University campus, and, after remaining an hour or more, departed. From this date until the 30th of April—nearly ten weeks—it was their custom to visit the campus and remain until noon, when they would fly away and spend the remainder of the day elsewhere. During their stay, the food of these birds consisted chiefly of the *samaræ* of the box-elders and sugar maples, the young leaf-buds of various trees, seeds, and grain; to obtain the latter the whole flock would often alight on the ground and eagerly devour the scattered grain. As spring advanced they were usually seen, especially early in the morning, in the top of some tree, singing or chattering noisily, thus attracting the attention of nearly every passer-by. Their loud, clear, rather harsh, piping notes, uttered in concert, reminded one forcibly of the familiar chorus of the rusty blackbirds in the spring, and have also been likened to the shrill piping rising from some frog-pond on a quiet summer evening."* This species has appeared in the vicinity of Iowa City on two different occasions, February, 1884, and the winter of 1886–7. It is also reported from Charles City in March; Grinnell, December, April, and May; and at Burlington in the southeastern part of the State.

Genus **PINICOLA** Vieillot.

[B 304, R 166, C 190, U 515.]

Pinicola enucleator (Linn.). Pine Grosbeak. Winter visitant; rare. During the winter of 1878–9, a few small flocks appeared in the vicinity of Charles City.

Genus **CARPODACUS** Kaup.

[B 305, R 168, C 194, U 517.]

Carpodacus purpureus (Gmel.). Purple Finch. Spring and fall migrant; abundant. In central Iowa it usually appears about the last of

*C. R. Keyes, Occurrence of *Coccothraustes vespertina* in Iowa. The Auk, Vol. V., p. 114. Abstract of a paper read at the Fifth Meeting of the American Ornithologist's Union, held at Boston, October 11–13, 1887.

February, and remains until May; the fall sojourn is from the middle of October to the middle of December. It frequents orchards and open woodland.

GENUS **LOXIA** LINNÆUS.

[B 318, R 172, C 199, U 521.]

Loxia curvirostra minor (Brehm.). American Cross-bill. An irregular winter visitor. Generally seen from the middle of October until the first week in May. At Charles City, during the spring of 1878, it appeared in large numbers, remaining until the end of the first week in May. In July of the same year, a flock was also noticed in Floyd County.

[B 319, R 173, C 198, U 522.]

Loxia leucoptera Gmel. White-winged Cross-bill. Rare; usually noticed only in mid-winter.

GENUS **ACANTHIS** BECHSTEIN.

[B 320, R 179, C 207, U 528.]

Acanthis linaria (Linn.). Red-poll. Winter visitant; irregular, but usually abundant during its sojourns. In February it has been noticed feeding upon the seeds of the rag-weed *(Ambrosia)*.

GENUS **SPINUS** KOCH.

[B 313, R 181, C 213, U 529.]

Spinus tristis (Linn.). American Goldfinch. Resident; abundant. In winter it frequents the fields and borders of woodland, feeding upon the seeds of the rag-weed. The flocks often contain several hundred birds, but as warm weather approaches their number daily diminishes, until about the middle of June, when there are but few individuals remaining in the company. It breeds in July and August.

[B 317, R 185, C 212, U 533.]

Spinus pinus (Wils.). Pine Siskin. Winter visitant; not common.

GENUS **PLECTROPHENAX** STEJNEGER.

[B 325, R 186, C 219, U 534.]

Plectrophenax nivalis (Linn.). Snowflake. Winter sojourner; confined almost exclusively to the fields and prairies. It is quite common in the northern parts of the State; rare in southern portion, where it is seen only during severe winters.

GENUS **CALCARIUS** BECHSTEIN.

[B 326, R 187, C 220, U 536.]

Calcarius lapponicus (Linn,). Lapland Longspur. Winter visitor; abundant. Associates with *Plectrophenax nivalis*, and is more common than that species.

[B 327, R 188, C 221, U 537.]

Calcarius pictus (Swains.). Smith's Longspur. Migratory; common. Appears about the middle of April, in companies of fifty or more, and frequents old "stubble" fields. In crossing a field, a bird suddenly darts out from nearly under the feet of the observer, and flies upward, nearly perpendicularly, almost out of sight. A few steps further, and a couple of more do likewise, and, shortly after, again, several others. After a few minutes they drop to the ground, three or four hundred feet in advance. As they rise they give utterance to their peculiar notes, and, on alighting, begin feeding again, unconcernedly. By cautiously advancing, several may be secured. Upon dissection, the food is found to consist of grain and seeds of various weeds.

Genus **POOCÆTES** Baird.

[B 337, *part*, R 197, C 232, U 540.]

Poocætes gramineus (Gmel.). Vesper Sparrow. Common migrant, arriving the first week in April. Doubtless also a summer resident.

Genus **AMMODRAMUS** Swainson.

Subgenus PASSERCULUS Bonaparte.

[B 332, R 193 *a*, C 227, U 542 *a*.]

Ammodramus sandwichensis savanna (Wils.). Savanna Sparrow. Migratory; common. Arrives early in April. Doubtless breeds within the limits of the State. It has been observed during the summer in the prairie sloughs of Polk County.

Subgenus COTURNICULUS Bonaparte.

[B 338, R 198, C 234, U 546.]

Ammodramus savannarum passerinus (Wils.). Grasshopper Sparrow. Summer resident; common from the middle of April until October. Breeds in the fields and prairies.

[B 339, R 199, C 236, U 547.]

Ammodramus henslowii (Aud.). Henslow's Sparrow. Summer resident; common. Arrives about the same time as the last species, with which it associates.

[B 340, R 200, C 237, U 548.]

Ammodramus leconteii (Aud.). Leconte's Sparrow. Rather common. Seen usually in the spring, in the grass of sloughs near woodland.

Genus **CHONDESTES** Swainson.

[B 344, *part*, R 204, C 281, *part*, U 552.]

Chondestes grammacus (Say). Lark Sparrow. Summer resident; common from the middle of April until October. In the spring it is

first noticed along the roadsides and in fields, where, a little later in the season, it breeds.

GENUS **ZONOTRICHIA** SWAINSON.

[B 348, R 205, C 280, U 553.]

Zonotrichia querula (Nutt.). Harris's Sparrow. Migratory; common. In central Iowa it appears the third week in April, and sojourns until the middle of May. In the fall it is usually noticed from the middle to the last of October. During the latter part of September, 1880, it was very abundant at Spirit Lake, Dickinson County.

[B 345, R 206, C 276, U 554.]

Zonotrichia leucophrys (Forst.). White-crowned Sparrow. Migratory; rather common. Frequents open woodland.

[B 349, R 209, C 275, U 558.]

Zonotrichia albicollis (Gmel.). White-throated Sparrow. Migratory; abundant from the middle of April to the middle of May, and from the middle to the last of October.

GENUS **SPIZELLA** BONAPARTE.

[B 357 *part*, R 210, *part*, C 268, *part*, U 559.]

Spizella monticola (Gmel.). Tree Sparrow. Abundant migrant and common winter resident from October to April. Associates with the juncos and goldfinches.

[B 359, *part*, R 211, C 269, U 560.]

Spizella socialis (Wils.). Chipping Sparrow. Summer resident; very common from March until the middle of October. Perhaps the most familiar of our sparrows. Builds its nest in evergreens and vines in door-yards; and in hawthorn and similar trees in open woodland.

[B 360, R 212, C 272, U 561.]

Spizella pallida (Swains.). Clay-colored Sparrow. Migratory; common. Arrives early in May and frequents open woodland.

[B 358, R 214, C 271, U 563.]

Spizella pusilla (Wils.). Field Sparrow. Summer resident; common from early in April to October. The nest is usually placed in a tuft of grass, and is composed of dried grasses which are interwoven with the living grass, and lined with hair. Eggs usually four in number.

GENUS **JUNCO** WAGLER.

[B 354, R 217, C 261, U 567.]

Junco hyemalis (Linn.). Slate-colored Junco. Spring and fall migrant; abundant. Many remain from October to April.

GENUS **PEUCÆA** AUDUBON.

[B 370, *part*, R 226 *a*, C 252 U, 575 *a*.]

Peucæa æstivalis bachmanii (Aud.). Bachman's Sparrow. This species is entered here upon the following data: On the 2d of June, 1884, Mr. J. B. Green, of Des Moines, while collecting, several miles east of the city, passed through several fields in search of the eggs of the yellow-winged sparrow, and other ground-nesting species which were known to breed there. Mr. Green says: "I had passed through a corn-field and had just entered a field of clover, when I started from nearly under my feet, a sparrow somewhat larger than a yellow-winged, but not having my gun with me, I was unable to secure it. After a brief search I discovered a nest containing five white eggs, which being without markings, I knew did not belong to a *Coturniculus;* but not wishing to take the eggs without, at least, a good look at the bird, I continued hunting for other nests, while awaiting its return to the nest. After a time I returned, with more caution than before, and again flushed the bird, but this time I succeeded in noting more carefully its appearance, which, on arriving home, and taking into consideration the eggs, corresponded with *Peucæa æstivalis bachmanii.* The nest was placed in a slight depression at the base of a tuft of clover, and was composed of dry grasses, lined with finer materials and a few hairs."

Two of the eggs were sent to Professor J. A. Allen for further identification. Mr. Allen replied:

"I have compared the eggs with those of *Peucæa æstivalis, P. cassini*, and *P. carpalis*, and with those other species laying white, or whitish eggs. Taking into account the situation of the nest — on the ground — and the geographical distribution of the other species of *Peucæa*, and the few other species of finch which lay white eggs, I should say that your conclusions that these eggs are those of *P. æstivalis bachmanii* is highly probable — in fact, almost beyond question. I find, however, that the eggs sent are absolutely indistinguishable from those of *P. carpalis*, to which, of course, for geographical reasons, they cannot belong; and they are also indistinguishable from eggs of *Poospiza (Amphispiza) belli*, which is a species likewise out of the question, for geographical reasons. The eggs of *P. æstivalis* are a little larger, and a purer, glossy white, as are also those of *P. cassini*, differing from the eggs of both of these species quite markedly in both of these particulars. Your eggs have a slight bluish cast, and in this respect, and in size, also similar to the eggs of *Cyanospiza cyanea*. Had not the nest been placed on the ground, I should have said that they were eggs of this species. If *P. æstivalis bachmanii* occurs with you, it would

seem that they *must* be the eggs of that bird. And the only question I can see about them is whether they may not be those of *Cyanospiza cyanea;* but the position of the nest seems to render this improbable."

GENUS **MELOSPIZA** BAIRD.

[B 363, R 231, C 244, U 581.]

Melospiza fasciata (Gmel.). Song Sparrow. Migratory; abundant. Resident in small numbers through the summer.

[B 368, R 234, C 242, U 583.]

Melospiza lincolni (Aud.). Lincoln's Sparrow. Migratory; common from the 20th of April to the middle of May, and from the middle to the last of October. It frequents the underbrush in open woodland, where it is found in scattered flocks, in company with other sparrows.

[B 369, R 233, C 243, U 584.]

Melospiza georgiana (Lath.). Swamp Sparrow. Common spring and fall migrant, arriving about the middle of April, and in the autumn in September. Doubtless breeds in the State, in wet and marshy ground.

GENUS **PASSERELLA** SWAINSON.

[B 374, R 235, C 282, U 585.]

Passerella iliaca (Merr.). Fox Sparrow. Spring and fall migrant; abundant. Arrives the last week in March, and remains about a month; in the fall it is noticed from the first to the last week in October. This species, in size and color, resembles some of our thrushes, and, as its habits and haunts are not unlike those of the *Turdidæ*, it might readily be mistaken, at first sight, for a member of that family. Its arrival is first made known by the appearance of a few individuals in open woodland, but in three or four days it becomes common and wanders about in scattered flocks.

GENUS **PIPILO** VIEILLOT.

[B 391, R 237, C 301, U 587.]

Pipilo erythrophthalmus (Linn.). Towhee. Summer resident; common; arriving the last week in March, and departing in October. It frequents the open woodland, where it usually nests on the ground, under some bush, but sometimes the nest is placed in a shrub.

GENUS **CARDINALIS** BONAPARTE.

[B 390, R 242, C 299, U 593.]

Cardinalis cardinalis (Linn.). Cardinal. Not common. Only occasionally seen in central Iowa, but noticed more often in the southern portion of the State. It has been taken in the latter part of December, at Iowa City.

GENUS **HABIA** REICHENBACH.

[B 380, R 244, C 289, U 595.]

Habia ludoviciana (Linn.). Rose-breasted Grosbeak. Summer resident; common, arriving the last of April, and remaining until the last of September. It nests in orchards and open woodland in the vicinity of streams. The nest is placed at various heights—from eight to forty feet from the ground—usually from ten to twenty. The eggs are generally four in number, often three, and occasionally five. In this vicinity it has never been found nesting in bushes, as has been reported from many other localities. A fine albino of this species was taken at Des Moines in July, 1885. The elegant plumage and melodious song makes this species very desirable as a cage bird.

GENUS **PASSERINA** VIEILLOT.

[B 387, R 248, C 295, U 598.]

Passerina cyanea (Linn.). Indigo Bunting. Summer resident; common from the first week in May until September.

GENUS **SPIZA** BONAPARTE.

[B 378, R 254, C 287, U 604.]

Spiza americana (Gmel.). Dickcissel. Summer resident; abundant from the last of April until October. It is one of the most familiar species of the fields and meadows, where it may be seen perched upon the top of some weed or small tree, uttering at short intervals its monotonous notes.

FAMILY **TANAGRIDÆ.** TANAGERS.

GENUS **PIRANGA** VIEILLOT.

[B 220, R 161, C 154, U 608.]

Piranga erythromelas Vieill. Scarlet Tanager. Summer resident; common. In central Iowa it arrives about the last of April, and remains until the middle of September. A rather retiring bird, usually met with in the timber bordering the streams. Breeds about the last of May. The nest is usually placed upon a horizontal limb, thirty or forty feet from the ground, and almost invariably contains, besides its own eggs, from one to three of the cowbird *(Molothrus ater)*.

[B 221, R 164, C 155, U 610.]

Piranga rubra (Linn.) Summer Tanager. Rare. During the season of 1880, this species was observed at Des Moines, and three nests with eggs taken, but since then has not been noticed in that vicinity. One of the nests taken July 23d, contained two eggs about half incubated. The nest was placed on the horizontal limb of an elm tree in a rather open grove, and was about fifteen feet from the ground.

Eggs similar to those of *P. erythromelas*. Both birds came within a dozen feet of the intruder, and were distinctly seen. The absence of the black of the tail and wings of the male and the whitish bill were points noticed as unequivocally distinguishing this species from its near relative. The other two nests each contained three eggs, and were taken in the immediate vicinity of the one just mentioned.

Family HIRUNDINIDÆ. Swallows.

Genus PROGNE Boie.

[B 231, R 152, C 165, U 611.]

Progne subis (Linn.). Purple Martin. Summer resident; abundant. In central Iowa it usually arrives the last week in March, and departs before the middle of September. The eggs are laid the last of May. After the young are fledged the birds assemble in flocks, usually selecting some large dead tree as a place of rendezvous, the young birds remaining most of the time on the tree, and are fed by the old ones. This is continued until the young are able to take extended flights. They constantly increase in numbers until they depart for the south. A marked instance of this kind occurred at Des Moines in 1884. Towards the last of August, the martins began to gather around the spire of the First Methodist Episcopal Church. Their numbers daily increased until there were many hundreds. For several days the spire was literally black with the birds clinging to the sides and to every projection that afforded them a support. Many were continually dropping off and sailing away for a short flight, while others took possession of the places vacated. They remained in this way for several days, and then suddenly took their departure—for the next day not a bird was seen. After the flock had disappeared but few martins were noticed, and they were stragglers from elsewhere.

Genus PETROCHELIDON Cabanis.

[B 226, R 153, C 162, U 612.]

Petrochelidon lunifrons (Say.). Cliff Swallow. Summer resident; abundant from the first week in May until September. It nests in large colonies, under the eaves of barns and old mills. Nidification commences about the 20th of May. It is frequently noticed flying about over the prairies, far away from any habitation.

Genus CHELIDON Forster.

[B 225, R 154, C 159, U 613.]

Chelidon erythrogaster (Bodd.). Barn Swallow. Summer resident; common, but apparently somewhat irregular in its distribution. Arrives the middle of April, and remains until the middle of September. The

nest is attached to the rafters of old barns, or is placed under a bridge. The eggs are laid the last week in May. In the spring when it first arrives, it is seen skimming over the surface of ponds in company with other swallows, and is not unfrequently noticed flying over the fields at some distance from dwellings.

GENUS **TACHYCINETA** CABANIS.

[B 227, R 155, C 160, U 614.]

Tachycineta bicolor (Vieill.). Tree Swallow. Summer resident; rather common. Arrives about the first of May, and departs about the middle of September. Nests in cavities in trees, and boxes. In the spring it appears in company with the barn swallow.

GENUS **CLIVICOLA** FORSTER

[B 229, R 157, C 163, U 616.]

Clivicola riparia (Linn.). Bank Swallow. Summer resident; breeds abundantly in all parts of the State. A few miles above Muscatine a large colony of these birds occupies the perpendicular side of a deep excavation in a hill-side; the bank is literally honeycombed, and thousands of swallows flying about reminds one, at a distance, of a swarm of bees. Considerable confusion appears to exist among many observers, who confound this with the following species.

GENUS **STELGIDOPTERYX** BAIRD.

[B 230, R 158, C 164, U 617.]

Stelgidopteryx serripennis (Aud.). Rough-winged Swallow. Summer resident; abundant, arriving about the middle of April. In central Iowa, especially in Polk and the contiguous counties, this species is quite abundant, almost to the exclusion of the bank swallow. The nests are usually built in the alluvial banks of the streams, or in the sides of gravel pits and in road-cuts. Several years ago, three nests were taken in a cut which afforded a bank less than three feet in height. In the spring after its arrival, it may be seen flying about in the vicinity of the banks which it has selected for its future home. Usually there are ten to fifty or more pair occupying, with a few bank swallows, a cliff on a bend in a river. About the first or second week in May they commence excavating, for a nest, a hole to the depth of two or three feet. At the terminus of the excavation is placed the nest, which is usually composed of bits of hay and grass taken from a barn-yard. By the first of June the full complement of eggs—from five to seven—is laid; the period of incubation is about two weeks. A little careful observation will enable almost any one to distinguish between this species and preceding, even when on the wing and at some distance.

FAMILY **AMPELIDÆ**. WAX-WINGS, ETC.

SUBFAMILY AMPELINÆ. WAX-WINGS.

GENUS **AMPELIS** LINNÆUS.

[B 232, R 150, C 166, U 618.]

Ampelis garrulus Linn. Bohemian Wax-wing. Winter visitant; rather rare. During the winter of 1879–'80 large flocks of these birds visited the north-west. They came familiarly about the towns, feeding upon the berries of the mountain ash.

[B 233, R 151, C 167, U 619.]

Ampelis cedrorum (Vieill.). Cedar Wax-wing. Spring and fall migrant; abundant, and resident in small numbers throughout the year. In the fall it is noticed in abundance towards the last of October, feeding upon berries, with the juice of which its plumage, at this season, is much soiled. In the spring it is usually seen in small flocks towards the last of March or early in April. It appears in the orchards, feeding upon the apples which happen to be left upon the trees, and frequently alighting on the ground below and gorging itself with the decaying fruit. At Des Moines it is observed all the year. Nesting is postponed until late in the season, seldom being commenced before the first of July. Eggs have been taken at Iowa City, Charles City, and other localities in the State.

FAMILY **LANIIDÆ**. SHRIKES.

GENUS **LANIUS** LINNÆUS.

[B 236, R 148, C 186, U 621.]

Lanius borealis Vieill. Northern Shrike. Winter resident. Not uncommon from the last of October to March. When seen, it is usually solitary, and perched upon the topmost twig of some tree along roadsides. This and the next species are often confounded, and it has several times been reported as breeding within the limits of the State.

[B 238, R 149 *a*, C 188, U 622 *a*.]

Lanius ludovicianus excubitorides (Swains.). White-rumped Shrike. Summer resident; rather common. Begins nesting about the last of April; probably raising two broods in a season. On several occasions the full complement of eggs has been taken in the middle of June, after the earlier birds of the season are fledged and able to take care of themselves. The osage orange hedges are favorite nesting sites for this species. The nest is rather large, composed of sticks, twigs, leaves, hair, and an abundance of feathers. The eggs are usually six in number. When the young are fledged, it is not uncommon to see the whole

family of seven or eight perched upon the telegraph wires, or hunting in company along a hedge.

Family VIREONIDÆ. Vireos.

Genus VIREO Vieillot.

Subgenus VIREOSYLVA Bonaparte.

[B 240, R 135, C 170, U 624.]

Vireo olivaceus (Linn.). Red-eyed Vireo. Summer resident; rather common. Breeds in June. Its beautiful, pendulous nest is attached to the horizontal limb of some forest tree. The nest of this species is one which the cow-bird especially selects as a repository for its parasitic eggs.

[B 244, R 138, C 173, U 626.]

Vireo philadelphicus (Cass.). Philadelphia Vireo. Migratory; common; arriving the second week in May. It first appears in scattered companies, moving in leisurely flights through the tops of the trees along the water-courses, and associating with various species of warblers. In the fall it appears about the first of September.

[B 245, R 139, 139 *a*, C 174, 175, U 627.]

Vireo gilvus (Vieill.). Warbling Vireo. Common migrant and summer resident. Arrives about the first week in May, and remains until September. Nests in the cottonwoods and maples that grow along the country roadsides and the streets and gardens in towns.

Subgenus LANIVIREO Baird.

[B 252, R 140, C 176, U 628.]

Vireo flavifrons Vieill. Yellow-throated Vireo. Spring and fall migrant; common. Also summer resident. It appears about the first week in May, and departs about the first of September. At Des Moines it is a very rare summer resident — only one nest having been taken. This one was discovered on the 25th of June, 1881, in a ravine a short distance west of the city limits. The nest was pendulous — like the structures of the other species of *Vireo* — dotted over with little balls of cotton-like material and spider-webs. It was attached to the forks of a horizontal branch of a large white oak, some twelve feet from the main trunk, and twenty feet from the ground. It contained two newly-hatched young, and one egg with a well-developed embryo. The female was very courageous, and, though the branch on which the nest was situated was shaken quite violently several times, remained on her treasures so long that she barely escaped capture by the intruder. As soon as his hand was withdrawn, she was back again on her nest.

The male was not as brave, but kept at a safe distance, yet appearing very solicitous and restless while the nest was being disturbed.

[B 250, R 141, C 177, U 629.]

Vireo solitarius (Wils.). Blue-headed Vireo. Migratory; common. Arrives the first week in May, and passes southward the first of September. During the migratory periods it associates with various warblers and several species of its own genus.

SUBGENUS VIREO VIEILLOT.

[B 248, R 143, C 181, U 631.]

Vireo noveboracensis (Gmel.). White-eyed Vireo. Rare. Prof. H. W. Parker writes that he has taken it at Grinnell.

[B 246, R 145, C 183, U 633.]

Vireo bellii Aud. Bell's Vireo. Summer resident; common. "This is, perhaps, the most familiar summer resident of the genus. No other woodland bird appears to be so completely satisfied with so narrowly restricted a vertical range as this retiring and unobtrusive little greenlet. Though for the most part unseen, its voluble little melody, earnest and plaintive, ever betrays its presence in every hazel copse and garden. Its neat, pensile nest is suspended from the branchlet of some low bush, and here its eggs, four or five in number, are deposited the last week in May. One nest containing four eggs was found in a small bush situated within eight feet of a railroad track over which cars were passing continually, and, notwithstanding the violent swaying of the bush caused by the strong currents of air created by each rapidly-moving train, the young birds were successfully reared." *

FAMILY **MNIOTILTIDÆ**. WOOD-WARBLERS.

GENUS **MNIOTILTA** VIEILLOT.

[B 167, R 74, 74 *a*, C 91, 92, U 636.]

Mniotilta varia (Linn.). Black and White Warbler. Migratory; quite common; often arriving about the middle of April, and sojourning until the middle of May. In the fall it appears from the first to the third week in September. At Des Moines this species has been observed in June and July, and consequently may be regarded as a summer resident, though not a common one.

GENUS **PROTONOTARIA** BAIRD.

[B 169, R 75, C 95, U 637.]

Protonotaria citrea (Bodd.). Prothonotary Warbler. Summer resident; not uncommon, especially in the eastern part of the State. Arrives during the last week in April.

* C. R. Keyes, Iowa Greenlets. Ornithologist and Oologist, Vol. XIII., p. 44.

GENUS **HELMITHERUS** RAFINESQUE.

[B 178, R 77, C 96, U 639.]

Helmitherus vermivorus (Gmel.). Worm-eating Warbler. Migratory; not uncommon. In the spring arrives about the last of April, and in the fall about the 10th of September.

GENUS **HELMINTHOPHILA** RIDGWAY.

[B 180, R 79, C 98, U 641.]

Helminthophila pinus (Linn.). Blue-winged Warbler. Common migrant, and in part, summer resident. Arrives the first week of May, and remains until September. At Prospect Park, near Des Moines, a nest of this species was discovered on the 11th of June, 1884. The attention of the observer was first attracted by a male of this species moving restlessly about through the trees at the edge of an open field, overgrown with long grass and weeds. After watching the movements of the bird a few minutes, the observer started to cross the field, but when about thirty feet from the woods, a bird flew from almost beneath his feet. A nest containing three eggs was soon disclosed, but, as the identification of the bird was not beyond doubt, the place was visited the next day, and a female of this species captured on the nest. The nest, a beautiful example of avian architecture, was built in the grass at the foot of a weed about three feet high; a broad leaf of the plant spread directly above the little structure, effectually concealing it from view. It was composed of dry oak leaves as a foundation; upon this were numerous rootlets and stems of plants interwoven with the surrounding grass, and lined with finer materials. It contained four fresh eggs—rosy white, before the contents were removed, dotted with spots of reddish-brown, and a few of lavender.

[B 181, R 81, C 102, U 642.]

Helminthophila chrysoptera (Linn.). Golden-winged Warbler. Migratory; not common. Taken at Iowa City, and elsewhere in the State.

[B 183, *part*, R 85, *part*, C 106, *part*, U 645.]

Helminthophila ruficapilla (Wils.). Nashville Warbler. Spring and fall migrant; abundant. Arrives about the first, and remains until the third, week in May; passes southward in September. It is usually noticed in flocks of forty or fifty, moving leisurely through the tops of the large trees along the streams.

[B 184, *part*, R 86, C 107, U 646.]

Helminthophila celata (Say.). Orange-crowned Warbler. Spring and fall migrant; rather common. Arrives the first of May, and remains until the middle of the month; passes southward again the first

week in September. It frequents rather open woodland, and seems to be extremely partial to the hawthorn trees. Its plumage — greenish-yellow, or olive, is nearly the same hue as that of the young foliage of the hawthorn, so that the birds are likely to be passed by unnoticed, unless especially sought for.

[B 185, R 87, C 109, U 647.]

Helminthophila peregrina (Wils.). Tennessee Warbler. Migratory; abundant. Arrives the first, and sojourns until the third week in May, passing southward again in September. It is an inconspicuous little species, frequenting the tops of trees, and often associating with the brotherly-love vireo.

Genus COMPSOTHLYPIS Cabanis.

[B 168, R 88, C 93, U 648.]

Compsothlypis americana (Linn.). Parula Warbler. Rather common; observed only on migrations. Arrives the first week in May, and passes southward the second week in September.

Genus DENDROICA Gray.

Subgenus PERISSOGLOSSA Baird.

[B 206, R 90, C 126, U 650.]

Dendroica tigrina (Gmel.). Cape May Warbler. Migratory; not common. Arrives the second week in May, and returns in September. A specimen was taken at Iowa City, November 27th, 1886.

Subgenus DENDROICA Gray.

[B 203, R 93, C 111, U 652.]

Dendroica æstiva (Gmel.). Yellow Warbler. Summer resident; abundant. Arrives the first of May, and departs the first of September. Nests about the third week in May, in low bushes. Eggs, four or five in number. As many as three eggs of the cow-bird have been taken from a single nest of this species.

[B 193, R 94, C 117, U 654.]

Dendroica cærulescens (Gmel.). Black-throated Blue Warbler. Migratory; not common. Mr. Trippe also mentions it as having been seen a few times in the spring, in Mahaska County.

[B 194, R 95, C 119, U 655.]

Dendroica coronata (Linn.). Myrtle Warbler. Abundant spring and fall migrant, appearing about the middle of April, and remaining three or four weeks; in the fall its sojourn is shorter — from the middle to the last of October. It is one of the first of the warblers to put in its appearance in the spring, and may be seen at almost any place in woodlands during its stay.

[B 204, R 97, C 125, U 657.]

Dendroica maculosa (Gmel.). Magnolia Warbler. Spring and fall migrant; common. Arrives the first, and remains until the third week in May; in the fall it is to be seen from the last week in August, to the middle of September. In company with others of its genus, it is usually found feeding in the upper branches of the trees along the water-courses.

[B 201, R 98, C 118, U 658.]

Dendroica cærulea (Wils.). Cerulean Warbler. Migratory; not common, at least as far as personal observation goes. In his notes on the birds observed in western Iowa, in July, August, and September of 1867, Mr. J. A. Allen states that this species was "quite common at Boonesboro, keeping chiefly in the tops of high trees, and was the only woodland *Dendroica* observed there." Mr. T. M. Trippe, in his notes on the birds of southern Iowa (1872), states that it was "common, and breeds."

[B 200, R 99, C 124, U 659.]

Dendroica pensylvanica (Linn.). Chestnut-sided Warbler. Migratory; abundant, arriving the first week in May, and departing before the middle of September. Also a summer resident, not uncommon.

[B 197, R 100, C 123, U 660.]

Dendroica castanea (Wils.). Bay-breasted Warbler. Migratory; not common. Arrives the first week in May.

[B 202, R 101, C 122, U 661.]

Dendroica striata (Forst.). Black-poll Warbler. Common migrant from the first to the middle of May. It is usually seen among the lower branches of the trees in dark, damp woodland.

[B 196, R 102, C 121, U 662.]

Dendroica blackburniæ (Gmel.). Blackburnian Warbler. Migratory; not common. Arrives the first week in May.

[B 189, R 107, C 112, U 667.]

Dendroica virens (Gmel.). Black-throated Green Warbler. Common spring and fall migrant, arriving the first of May, and returning in September. Perhaps breeds in the State, inasmuch as it has been noticed several times during the month of June.

[B 208, *part*, R 113, C 132, U 672.]

Dendroica palmarum (Gmel.). Palm Warbler. Migratory; abundant. Appears about the 20th of April, and remains until the 10th of May. Its arrival is heralded by the appearance of a few males, which frequent open woodland; a few days later others, comprising both

sexes, appear and proceed leisurely along the water-courses, in company with *D. coronata* and others.

GENUS **SEIURUS** SWAINSON.

[B 186, R 115, C 135, U 674.]

Seiurus aurocapillis (Linn.). Oven Bird. Summer resident; common; arriving about the first of May, and remaining until the middle of September. Breeds about the third week in May, in hilly woodland, where, at this season of the year it seldom fails to attract notice by its loud, impetuous cries. The nest is commonly placed in a slight depression in the ground and is arched over, the entrance being at the side. Even thus hidden from observation, it does not escape the keen eyes of the cow-bird, which often deposits its eggs in the nest of this species.

[B 187, *part*, R 116, C 136, U 675.]

Seiurus noveboracensis (Gmel.). Water-thrush. Summer resident; not common. Arrives early in May. Usually observed in dark, marshy woodlands. A few miles north of Des Moines, a female of this species was taken in June, 1884; it was feeding young just from the nest.

[B 188, R 117, C 138, U 676.]

Seiurus motacilla (Vieill.). Louisiana Water-thrush. Migratory; common; arriving about the middle of April, and passing southward in September. When it arrives in the spring it is noticed about the pools and creeks in low woodland, where it walks about the edge of the water in search of food, and looking, at casual sight, like a little spotted sandpiper, but when startled, flies to some tree near by, and goes through those evolutions of the tail which are characteristic of the wagtails. A few remain through the summer, and breed.

GENUS **GEOTHLYPIS** CABANIS.

SUBGENUS GEOTHLYPIS CABANIS.

[B 172, R 120, C 142, U 679.]

Geothlypis philadelphia (Wils.). Mourning Warbler. Migratory; rather common in the underbrush and willows on the low lands along the streams. Sojourns in spring until the third week in May.

[B 170, *part*, R 122, *part*, C 141, *part*, U, 681 *a*.]

Geothlypis trichas occidentalis Brewst. Western Yellow-throat. Summer resident; common. Arrives the last of April and remains until September. Haunts similar to those of *G. philadelphia;* and also hedges and shrubbery.

Genus **ICTERIA** Vieillot.

[B 176, R 123, C 144, U 683.]

Icteria virens (Linn.). Yellow-breasted Chat. Summer resident; rather common; arriving the first week in May. Haunts the low, open woodlands and thickets along the streams. Nidification commences about the first week in June. The nest is usually placed four or five feet from the ground, in a thickly-foliaged bush. It is composed of dry grasses and leaves, lined with fine grasses and fibres of bark. The eggs number three to five.

Genus **SYLVANIA** Nuttall.

[B 211, R 124, C 146, U 684.]

Sylvania mitrata (Gmel.). Hooded Warbler. Not common. Mr. Trippe also mentions taking one in Mahaska County, in May.

[B 213, *part*, R 125, C 147, U 685.]

Sylvania pusilla (Wils.). Wilson's Warbler. Migratory; common. Arrives the first, and sojourns until the third, week in May; passes southward the second week in September. It is usually noticed in the underbrush in open woodland along the streams.

[B 214, R 127, C 149, U 686.]

Sylvania canadensis (Linn.). Canadian Warbler. Spring and fall migrant; not common.

Genus **SETOPHAGA** Swainson.

[B 217, R 128, C 152, U 687.]

Setophaga ruticilla (Linn.). American Redstart. Summer resident; common; arriving the first week in May, and departing the second week in September. Nidification commences the first of June.

Family **MOTACILLIDÆ**. Wagtails.

Genus **ANTHUS** Bechstein.

Subgenus ANTHUS.

[B 165, R 71, C 89, U 697.]

Anthus pensilvanicus (Lath.). American Pipit. Migratory; common; arriving about the middle of April.

Family **TROGLODYTIDÆ**. Wrens, Thrashers, Etc.

Subfamily MIMINÆ. Thrashers.

Genus **MIMUS** Boie.

[B 253, 253 *a*, R 11, C 15, U 703.]

Mimus polyglottos (Linn.). Mocking Bird. Rare. A single specimen was taken at Charles City. Prof. H. W. Parker reports taking it several times at Grinnell.

Genus **GALEOSCOPTES** Cabanis.

[B 254, R 12, C 16, U 704.]

Galeoscoptes carolinensis (Linn.). Cat-bird. Summer resident; abundant from the last of April to October. Nests in orchards and thickets.

Genus **HARPORHYNCHUS** Cabanis.

Subgenus METHRIOPTERUS Reichenbach.

[B 261, 261 *a*, R 13, C 17, U 705.]

Harporhynchus rufus (Linn.). Brown Thrasher. Summer resident; abundant from April to the last of September. Nests in hedges and brush-heaps, about the 10th of May. One of our finest songsters. Soon after its arrival, it is noticed in the top of some tall tree, pouring forth its sweetest melodies — often for hours at a time — when, becoming conscious of an audience it suddenly ceases, darts into the thicket below, and is lost to view.

Subfamily TROGLODYTINÆ. Wrens.

Genus **SALPINCTES** Cabanis.

[B 264, R 58, C 65, U 715.]

Salpinctes obsoletus (Say.). Rock Wren. Not common. Mr. Trippe also notes a specimen taken in Decatur County.

Genus **TROGLODYTES** Vieillot.

Subgenus TROGLODYTES.

[B 270, 272, R 63, C 74, U 721.]

Troglodytes aedon Vieill. House Wren. Summer resident; common; arriving in April, and departing about the middle of September. Raises two or three broods in a season; a nest with fresh eggs has been taken as late as the second week in August. As is well known, its nest is built in all sorts of places. A singular instance came under the observer's notice while examining the nests of a colony of cliff swallows. One of the swallows' nests was noticed to have a number of straws protruding from the entrance. The side of the nest was carefully broken away, and the nest inside extracted. It was composed of a few straws and hairs, and lined with hair and feathers. It contained three eggs of *T. aedon*. The nest was picked to pieces, and the bottom was found to be made of the body of a half-decomposed swallow.

Subgenus ANORTHURA Rennie.

[B 273, R 65, C 76, U 722.]

Troglodytes hiemalis Vieill. Winter Wren. Migratory; not common.

Genus **CISTOTHORUS** Cabanis.

Subgenus CISTOTHORUS.

[B 269, R 68, C 81, U 724.]

Cistothorus stellaris (Licht.). Short-billed Marsh Wren. Summer resident; rather common. Breeds in the prairie sloughs.

Subgenus TELMATODYTES Cabanis.

[B 268, R 67, 67 *a*, C 79, 80, U 725.]

Cistothorus palustris (Wils.). Long-billed Marsh Wren. Migratory; common. Appears about the first week in May, about the prairie sloughs, where it breeds.

Family **CERTHIIDÆ**. Creepers.

Genus **CERTHIA** Linnæus.

[B 275, R 55, C 62, U 726.]

Certhia familiaris americana (Bonap.). Brown Creeper. Migratory; common; and resident from September to the last of April. A sprightly little creature frequenting woodland, though seldom attracting attention unless carefully sought for. Its plumage is nearly the hue of the bark of many trees, so that it is almost impossible for the eye to follow it after the bird has alighted and commenced ascending a tree. It begins near the bottom, winds its way upward spirally, for, perhaps, forty or fifty feet, when it suddenly drops to the foot of another tree twenty or thirty yards away and repeats the manœuvre, ever and anon picking out some unfortunate insect larva from a crevice in the bark, and uttering, at short intervals, its low, lisping notes.

Family **PARIDÆ**. Nuthatches and Tits.

Subfamily SITTINÆ. Nuthatches.

Genus **SITTA** Linnæus.

[B 277, R 51, C 57, U 727.]

Sitta carolinensis Lath. White-breasted Nut-hatch. Resident; common. During the winter it is usually to be seen in company with the chickadees. On the 15th of April, 1880, a set of five eggs of this species was taken from a cavity thirty feet from the ground, in a large white oak. The nest was visited quite frequently for the next two or three weeks — until fifteen eggs had been taken. The bird was captured on the nest on three different occasions, and after being handled carefully for a few minutes, set at liberty.

[B 279, R 52, C 59, U 728.]

Sitta canadensis Linn. Red-breasted Nuthatch. Migratory; rare.

SUBFAMILY PARINÆ. TITMICE.

GENUS **PARUS** LINNÆUS.

SUBGENUS LOPHOPHANES KAUP.

[B 285, R 36, C 40, U 731.]

Parus bicolor Linn. Tufted Titmouse. Northern Iowa, rare; central Iowa, not common; southern Iowa, "abundant; resident throughout the year." (Trippe).

SUBGENUS PARUS LINNÆUS.

[B 290, R 41, C 44, U 735.]

Parus atricapillus Linn. Chickadee. Resident; abundant. Nests in cavities in stumps. Eggs, six to ten in number, but usually seven; they are laid during the last week in April, or first in May. Not infrequently the nest is found at a height of ten or twelve feet from the ground. During the cold months the chickadee is to be seen almost every day — even in towns — but as spring approaches it retires to the woods to breed, and is not often noticed unless especially sought for in its favorite haunts. About the middle of September it again comes out of the secluded woodland where it has passed the summer.

FAMILY **SYLVIIDÆ**. WARBLERS, KINGLETS, GNATCATCHERS.

SUBFAMILY REGULINÆ. KINGLETS.

GENUS **REGULUS** CUVIER.

[B 162, *part*, R 33, C 34, U 748.]

Regulus satrapa Licht. Golden-crowned Kinglet. Common spring and fall migrant. In the spring arrives a few days earlier than *R. calendula*, and in the fall remains later. During the vernal migration it appears to prefer the tops of forest trees, while its congener is usually found in the small trees and bushes. In the fall it is found among the low willows along the streams.

[B 161, R 30, C 33, U 749.]

Regulus calendula (Linn.). Ruby-crowned Kinglet. Spring and fall migrant; abundant; arriving about the 10th of April, and sojourning three or four weeks.

SUBFAMILY POLIOPTILINÆ. GNATCATCHERS.

GENUS **POLIOPTILA** SCLATER.

[B 282, R 27, C 36, U 751.]

Polioptila cærulea (Linn.). Blue-gray Gnatcatcher. Summer resident; rather common. Arrives the middle of April, and remains until the last of September. The nest is usually placed on a horizontal branch of an oak in the dense woodland. It is similar to that of the humming-bird, but slightly larger.

FAMILY **TURDIDÆ**. THRUSHES, SOLITAIRES, STONECHATS, BLUEBIRDS, ETC.

SUBFAMILY TURDINÆ. THRUSHES.

GENUS **TURDUS** LINNÆUS.

SUBGENUS HYLOCICHLA BAIRD.

[B 148, R 1, C 6, U 755.]

Turdus mustelinus Gmel. Wood Thrush. Abundant summer resident. Appears about the first of May, and remains until September. It frequents the cool, shady woodlands in the vicinity of streams, where it commences to breed two or three weeks after its arrival. The nest of this species seems to be the favorite of the cow-bird (*Molothrus ater*), as a repository for its eggs. So frequently is this the case, that one may collect for a whole season, and not find more than half a dozen sets of wood thrushes' eggs without these parasitic eggs — all the others having from one to four eggs of *M. ater* in addition to those of the thrush. Several instances have been noted in which the wood thrush was sitting on the eggs of the cow-bird, with none of its own; while, on the other hand, one nest contained four eggs of each species — eight in all.

[B 151, R 2, C 7, U 756.]

Turdus fuscescens Steph. Wilson's Thrush. Migrant, and summer resident. Several nests have been taken at Des Moines, which are thought to belong to this species.

[B 154, R 3, C 12, U 757.]

Turdus aliciæ Baird. Gray-cheeked Thrush. Migratory; common. Arrives the first week in May, and remains about three weeks. Usually found in company with the next, in woodland.

[B 153, R 4 *a*, C 13, U 758 *a*.]

Turdus ustulatus swainsonii (Cab.). Olive-backed Thrush. Migratory; abundant; sojourning two or three weeks on both the spring and fall migrations. It prefers the low, damp woodland bordering the streams, but is often seen in favorable localities along the bluffs, at a distance from the water-courses.

[B 149, R 5 *b*, C 10, U 759 *b*.]

Turdus aonalaschkæ pallasii (Cab.). Hermit Thrush. Migratory; rather common; arriving about the middle of April. It is generally seen in the woodland along the streams.

GENUS **MERULA** LEACH.

[B 155, *part*, R 7, C 1, U 761.]

Merula migratoria (Linn.). Robin. Summer resident; abundant. Our most familiar species, and one of the earliest harbingers of spring,

often appearing in February and remaining until November. Commences nesting about the middle of April. During the season of 1880, an unusually large set of six eggs was taken in north Des Moines. Its nest is often very firmly and compactly built, as is well illustrated by a nest examined several years ago. It was several hours after a rather severe rain storm, and the nest was still over half full of water, nearly submerging the three eggs it contained. Among the many curious phenomena of avian life, it is believed the following incident is somewhat novel: One morning during the spring of 1879, a great commotion was noticed among the birds a short distance from the house. On going out into the yard, the cause of their uneasiness was soon learned. A robin was suspended by means of a narrow strip of calico from a small branch, some fifteen feet from the ground. Further examination showed that the bird was dead, and that a foot or more of the calico (which was about three feet in length), had been swallowed by the unfortunate robin, and the other end of the strip had caught on the branch, leaving the bird suspended fifteen or twenty inches below.

GENUS **SIALIA** SWAINSON

[B 158, R 22, C 27, U 766.]

Sialia sialis (Linn.). Bluebird. Abundant. One of the first of our summer residents to put in an appearance in the spring—sometimes even preceding the robin. Nesting frequently begins early in April; and two or three broods are raised in a season. May 22, 1882, nest was found in a small cavity in a hawthorn tree; it contained four eggs of the bluebird, and one of the house wren (*Troglodytes aedon*). Occasionally the bluebird builds its nest in the excavations made by bank swallows in the sides of gravel pits.

[B 159, R 23, C 28, U 767.]

Sialia mexicana Swains. Western Bluebird. Occasionally taken in western Iowa. Also recorded as having been taken in the State by Mr. Atkinson.

THE NORTH-AMERICAN GENUS, CEANOTHUS,

With an Enumerated List, and Notes and Descriptions of Several Pacific Coast Species.

BY C. C. PARRY.

(*Read before the Academy, December 28, 1888.*)

SINCE the important additions to the exclusively North American genus, *Ceanothus*, L. made by the discoveries of Mr. Nuttall, on the Pacific coast, over fifty years ago (1836), and published in Vol. I., Flora of North America, nearly all the systematic work undertaken in defining species and arranging them in natural groups, has been mainly based on the fragmentary specimens accumulated in the large *herbaria*, remote from the region where they reach the fullest development.

The latest revision (not yet completed), by Professor Trelease, of the Shaw School of Botany, at St. Louis, Missouri, and published in the Proceedings of the California Academy of Sciences, Vol. I., 2d Series, pp. 110–118, enumerates thirty-two species, all but six of which belong to the Pacific coast district. This interesting synoptical list, embodying the latest results of herbarium study, and bringing together, in compact form, the scattered literature of this genus, shows, no less plainly, the lack of personal field observations, which would have helped to solve many of the dubious points here brought to view, the difficulties of which none can so well appreciate as the author himself.

With the present writer, whose field observations on the Pacific coast now cover a period of forty years, a growing interest has been felt, as renewed opportunities have offered for investigating, in their native haunts, the varied forms of this attractive genus; and, during the past decade, special attention has been given, by copious collections and field notes, to elucidate this subject in its strict botanical relations, some of the results of which are hereby presented, for the first time:

GENERAL OBSERVATIONS.

As a natural genus of plants, since its separation from the allied *Rhamnaceous* genera with which it was combined by Linnæus, it pre-

sents unusually well-defined and characteristic features. Thus whether seen in the wide-spread, typical species, *C. Americanus*, the minute-leaved *C. microphyllus* of the Southern Atlantic coast, the densely-branched, spine-clad *Ceanothi* of Mexico, or the more luxuriant forms of the Pacific coast, it presents the same assemblage of characters, in habit of growth, foliage, inflorescence, and fruit, to some of which points it may be well briefly to allude.

As a shrub, it, of course, fits in well with allied *Rhamnaceous* genera, in its densely-branched ramification; its tendency, especially in arid districts, to defend itself from aggression by terminating its interlocking branches with rigid spines, of which the botanical explorer is apt to carry away lasting mementoes. Its leaf venation is of such a marked character as to afford the fossil botanist some of the most reliable *data* for connecting the present vegetation with that of remote geological epochs.

The inflorescence, composed of a thyrsoid aggregation of irregular, fascicled umbels, is often prolonged in graceful plumes, either a pure or dull white, or various shades of blue, (never, as sometimes stated, yellow). The separate flowers, with their slender, colored pedicels, show inflexed calyx lobes, from the clefts of which spread out the hooded petals, which, at the proper season relax, to release the enclosed stamens, overtopping the trifid style. The massed flowers, though strictly speaking, hermaphrodite, are inclined to be polygamous, most of them, after the period of fertilization becoming effete, though a favored few develop fruit. Hybridity, which would seem to be largely favored by the profusion of showy and occasionally fragrant flowers, and which has been supposed to be largely instrumental in confusing species, is not a very troublesome feature in field observation, where alone it can be properly studied. By far the majority of species having a distinct geographical range and different periods of flowering, while even such as grow in close proximity and flower at the same time, each maintain their proper specific characters; while true hybrids, however puzzling in the herbarium, are, in their proper field of growth, readily traced to their ancestral sources.

The fruit, which so strongly simulates in external appearance some of the *Euphorbiaceous* genera as to have suggested a near relationship—though not carried out in other points—varies considerably in its size, its smooth or resinously-coated exocarp and its accessory appendages, but has otherwise very uniform characters of seed and pericarp. A fact not often noticed, but which is probably more or less true of all species, is that the rigid *Cocci*, when released from their attachment to

the indurated disc, expel their smooth-coated seeds through the ventral slit with considerable force. I have had occasion lately to notice this, even in herbarium specimens of nearly mature fruit, which when brought into a warm apartment, revealed their explosive nature by a continuous fusilade, till the ammunition was all expended and the fragments of the ruptured pericarp alone left to determine their carpological features. The manifest utility of this provision for disseminating seeds, will largely account for the gregarious habit of most of the species, and, no doubt, also serves as a protection against the aggression of omnivorous rodents, to say nothing of avaricious botanists.

There is still another feature of growth calling for some detailed notice. Contrary to the view presented by Professor Trelease in the paper above referred to, it is quite certain that nearly all the Pacific coast species develop their inflorescence from buds fully formed the previous season, and rarely from the shoots of the same year. As collecting botanists do not often gather belated specimens which would show the late-formed buds, it is quite likely that ordinary herbarium specimens do not clearly show the true conditions of future growth, and hence such a mistaken conclusion might be easily reached; but, as far as my observations go, it is only the well-known Eastern Atlantic species, together with the Mexican, *C. azureus*, and probably *C. decumbens* of the Sierra Nevada, that flower from the fresh-growing shoots of the same season.

The usual character of growth and inflorescence, as seen on the Pacific slope, may be here briefly stated: When seen in the season of late autumnal rest, and before the winter rains set in, or where, in the higher mountains the deep winter snows come on to protect the tender growth, the later leafy shoots show in their axils or terminal branches, a more or less distinct development of flower buds, closely enwrapped in protecting scales, the latter usually densely tomentose; as soon as growth commences, which in the lowlands, is often as early as January or February, and extending northward as late as May or June, the deciduous scales, each subtending a fasciculate cluster of pedicels, are pushed off, and the flower buds, often showing a lower series of leaf bracts, expand their flower clusters, which gradually elongate to their full development. In maturing fruit, the whole flowering branch, including the lower empty leaf bracts, lose their vitality and remain, after the expulsion of the seeds, as dead withered branches, surmounted by the remains of the indurated and brittle disc and calyx tube. It was probably on such a specimen of *C. sanguineus*, that Professor Trelease based his conclusion that it was the only species to develop flowers

from the old wood. It is only when the fruiting process is well advanced, that the summer shoots set to work to prepare flower buds for the next season, occasionally however, tempted by an early autumnal rain or favorable conditions of growth, to push out premature flower buds, which, in their starved aspect, show that they are out of season, associated as they are, with fully developed fruit of the same year.

CHARACTERS ON WHICH SPECIES AND GROUPS CAN BE MOST SATISFACTORILY DEFINED.

Before proceeding to an enumeration of the species here recognized in the accompanying synoptical list, it seems proper to dwell briefly on some of the most reliable characters, especially such as are brought to view in field observations, which afford the best means for defining species and arranging them in natural groups. And first, the ramification of *Ceanothus* offers some distinctive features. Thus, while the thrifty-growing species, such as *C. thyrsiflorus*, *C. arboreus*, *C. integerrimus*, and several others exhibit the usual prolonged growth and flexible branches, usually more or less angular when young, and destitute of spines; others, subjected to more arid conditions of soil and climate, show a disposition to branch at right angles to the main axis, which branches, failing to secure sufficient nourishment for prolonged growth, terminate abruptly in stiff spines, which, interlocking, form the thickets popularly known as *chaparral*. These contrasted characters, while clearly noticeable in certain groups, are not always sufficiently constant to define their limits.

Again, an important character, not always apparent in herbarium specimens, is the relative persistence of the foliage; thus, there are included in this genus, species with annually deciduous leaves, showing naked winter branches, while others are strictly evergreen, retaining their leaves indefinitely—while there is still a larger intermediate class, including most of the Pacific coast species, in which the leaves persist for at least two seasons, and never show purely naked stems on the upper branches. It is quite possible that these characters would accurately define three very distinct natural divisions, as will be partly indicated in the succeeding list.

Still farther the venation and pubescence of the leaves offers good distinguishing marks, and these being equally available to the closet and field botanist, have been largely relied on by the former to limit groups, and may, no doubt, be used to advantage, when properly combined and qualified by other constant characters, so that species otherwise widely diverse, may not be brought together in unnatural, artificial

groups. The characters of entire, serrate, or glandular leaves, seems to be more variable as a specific character, than is usually met with in other genera, but occasional exceptions to uniformity in this respect only emphasizes the importance of combining several characters in a complete description, so that if one fails, the others may hold good.

The leaf stipules furnish some well-marked characters; thus, while usually thin and fugaceous in the *Eu-ceanothus* section, in the group with annually deciduous leaves, they often persist till after the fall of the leaf, as may be frequently seen in older branches of *C. Americanus* and *C. azureus*. In the *Cerastes* section, they usually show a thickened, corky, persistent base, often remaining as verrucose excresences, while the slender tips are early deciduous.

The inflorescence, while quite uniform in its general features, as composed of an irregular series of umbellate clusters, offers good specific characters in its more or less compact or prolonged thrysoid development. The separate flowers offer no important distinctive characters, being remarkably uniform throughout, while the color, though usually constant in the same species, is occasionally variable.

The fruit offers some important distinctions in the shape and size of the *Cocci*, the smooth, fleshy, or resinous exocarp, and the presence or absence of crests or accessory appendages.

GEOGRAPHICAL RANGE.

The geographical distribution of the different species of this genus is usually well-defined, and holds very obvious relations to the variations of soil and climate. This is true not only of such as have the extended range of *C. Americanus*, but also applies to such as are limited to a comparatively small area. Wherever met with, they are inclined to be gregarious, due, as I have above suggested, to the character of expulsive capsules, by which the seed is self-sown in its own locality. The smooth, polished seeds, with their comparatively large cotyledons and a liberal supply of albumen, seem thus calculated not only to maintain their vitality under adverse conditions, but also to afford a vigorous growth under favorable circumstances. It is, no doubt, owing to these characters, that the Pacific coast of California constitutes the most suitable home for this genus, and in its varied aspects of soil and climate, invites to the largest display of specific forms. It thus happens that there is no considerable expanse of country in this region, especially on the foot-hills or the mountain slopes, that is without its exhibit of one or more of these characteristic shrubs. If asked to designate a spot where they occur in the greatest profusion and variety,

I should not hesitate to award the palm to the Santa Cruz range of mountains, where, in a few hours' climb, are brought to view such charming groups as *C. incanus*, *C. papillosus*, *C. Andersoni*, and *C. thyrsiflorus*, with its occasional hybrids, vying with each other in displaying the most refined tints of white or blue, or expanding into the clear atmosphere of early spring their delicate feathered plumes.

In the *Cerastes* section—almost peculiar to California—with their rigidly coriaceous, usually opposite leaves, there is still more tendency to aggregate in massed growths, but in such cases the thickets are mainly composed of single separate species, and, therefore, less subject to hybridization.

The confusion of specific forms, due to hybridization, admits of an easy solution in the field, where, by extended observation, each separate species can be studied in its undisturbed condition. Thus, if Mr. Howell, the active and intelligent botanical collector of Oregon and Washington Territory, would extend his observations only by a few hours' travel, as far as the central range of the Sierras, and the Sacramento Valley, he would not venture his opinion that he "is disposed to regard *C. prostratus* as only a variety of *C. cuneatus*."

In the accompanying list I have briefly indicated, by locality, the geographical range of such species as have come under my personal observation, but the *data* are yet wanting for determining accurately the range of all the species here represented.

In submitting a synoptical arrangement of the thirty-three species herewith enumerated, I have endeavored to bring them into simple, natural groups, without any attempt at elaborate classification, such, in fact, as they appear from the standpoint of a field observer. If varying in this respect from that of more studied efforts, I can only say, I write as I have seen. To the separate species in the numbered list, I have only added notes of such as are imperfectly known or needing correction, with fuller descriptions of several new species; referring to the well-known systematic writers on this genus, for the synonomy and literature of the same.

CEANOTHUS, L.

SYNOPTICAL LIST OF SPECIES.

A. § Eu-ceanothus. Branches flexible or rigidly spinose; leaves alternate, deciduous, or persistent for two years or more, pliable or sub-rigidly coriaceous, entire, crenately serrate or glandular-ciliate, triple-nerved from the base, or penni-nerved; stipules slender membranaceous, usually fugaceous; inflorescence axillary or terminal, compact or loosely

thyrsoid, proceeding from shoots of the same year, or from buds fully formed the previous season, the elongated peduncles more or less leafy bracted below; fruit smooth, or triangular carinate, exocarp frequently resinous. VI. groups—25 species.

Group I. Americanus.

Leaves renewed annually, broadly cordate to ovate, triple-nerved from the base, reticulately veined, pubescent to densely tomentose beneath, serrate; inflorescence mostly from the same season's growth—except No. 3.

1. *C. Americanus*, L. } Eastern Atlantic slope, extending to the
2. *C. ovatus*, Desf. } Rocky Mountains.
3. *C. sanguineus*, Pursh. North Pacific coast.
4. *C. decumbens*, Watson. Sierra Nevada of California.
5. *C. azureus*, Desf. Mexico.

Group II. Incanus.

Branches usually spinose; leaves ovate to orbicular, entire, or glandularly serrate, canescently pubescent, triple-nerved, with inconspicuous mid-veins.

6. *C. incanus*, Torr. & Gray. Santa Cruz Mountains.
7. *C. cordulatus*, Kellogg. Sierra Nevada.
8. *C. divaricatus*, Nutt. Southern California, including variety *eglandulosus*, Torr., which is the common form.
9. *C. intricatus*, n. sp. Densely branched, younger shoots hirsutely pubescent; leaves somewhat rigid, crowded on short stems, short petiolate, narrowly ovate (15 x 6 mm.), dull green above, hoary pubescent beneath, triple-nerved from the base, with inconspicuous mid-veins, more or less strongly revolute, margins entire, but glandularly ciliate; inflorescence short pedunculate, not exceeding the leaves—flowers not seen—fruit 4 mm. broad, smooth, with resinous exocarp, cocci with blunt apical crests.

Habitat:—Known only from fruiting specimens collected on the summit of Mount Tamalpais, Marin County, July, 1886, by Mrs. M. K. Curran; closely allied to *C. cordulatus*, but differing in the character of its foliage, and peculiar in its isolated locality.

10. *C. Fendleri*, Gray. Rocky Mountains of Colorado and New Mexico, to Arizona.
11. *C. depressus*, Benth. Central Mexico.

Group III. Sorediatus.

Branches not spinose; leaves strongly triple-nerved, glandularly crenate, usually densely tomentose beneath; flowers blue or white.

12. *C. sorediatus*, Hook. & Arn. Foot-hills of the Sacramento Valley. I am inclined to confine this species to the slender supple-branched and sparse leaved shrub of the district above designated. The leaves variable in size, 10–15 mm. in length, broadly ovate to subcordate, densely white tomentose beneath, irregularly glandular-crenate, short petiolate; stipules thicker than usual in this section; the inflorescence on the terminal branches is of a more intense azure blue than any species known to me. This is unquestionably the species described by Dr. Kellogg, Proceedings California Academy of Sciences, I., p. 55, as *C. azureus*. What has been generally referred to this species from Southern California, is an arborescent form of *C. hirsutus*, or possibly an undescribed species.

13. *C. arboreus*, Greene, Bull. Cal. Acad., II., p. 144. Only known on the islands off the Southern California coast.

14. *C. velutinus*, Dougl. Widely spread to the north and east of the Sierra Nevada.

15. *C. hirsutus*, Nutt. Coast ranges of Santa Barbara and southward. This species needs a more careful field study than it has yet received to verify Nuttall's original description — Fl. N. Am., I., p. 266 — till which time much doubt will attach to the various forms included in herbaria from widely remote localities. As seen in the southern coast range, what has been recognized as *C. hirsutus* is a tall shrub, with tree-like trunk, and slender, minutely verrucose branches, not conspicuously hirsute; the leaves very finely glandular serrate, deep green above, pale and closely pubescent beneath; inflorescence terminating in short, leafy shoots, oval, compact, of a dull purplish blue; fruit 4 mm. broad, distinctly three-lobed, smooth and bluntly crested. *C. oliganthus*, Nutt., which has been referred to this species, should, from the fruit character, be distinct, and the specimens from the Upper Sacramento and East Humboldt Mountains must undoubtedly belong to a very different and probably undescribed species.

Group IV. Thyrsiflorus.

Young branches angular; leaves oblong, conspicuously veined, either triple-nerved or penninerved, usually tomentose beneath, more or less revolute, glandular-serrate, or papillose glandular on the surface; in-

florescence long pedunculate, diffusely thyrsoid, or compactly globose; inclined to hybridize with other species of this group.

Leaves triple-nerved.

16. *C. thyrsiflorus*, Esch. Central California, near the coast, with three well-marked hybrid forms, viz.:

a. *C. thyrsiflorus* × ——— (?) = *C. Lobbianus*, Hook.

b. *C. thyrsiflorus* × ——— (?) = *C. Veatchianus*, Hook.

c. *C. thyrsiflorus* × *C. papillosus.*

Of this last only, have I sufficiently definite information to refer the specimens collected to the two parent forms. These showing their ordinary specific characters unchanged, were growing luxuriantly along the sides of a wild mountain road, the low-branched *C. papillosus* being often overtopped by its more aspiring rival, *C. thyrsiflorus*. The season of flowering being the same in both, they were equally attractive to swarming insects, the natural result being noticed in occasional dwarf bushes partaking of a mixed character; thus, while the leaves conspicuously veined beneath, show a tendency to triple nerves, these do not extend to the base of the leaf, and towards the apex take on the penni-nerved character of *C. papillosus*, but without papillæ on the upper surface. The inflorescence is after the compact pattern of *C. papillosus*, and the fruit, which occasionally perfects its seed, is also nearest to the latter species. From this instructive example I have little hesitation in reducing the forms *a.* and *b.* to a similar origin, and thus relieve systematic botany from the burden of carrying doubtful species, though it will require direct field observation to assign them to their double parentage.

Leaves penninerved.

17. *C. Parryi*, Trelease, l. c. I have little to add to the well-characterized description of Professor Trelease, except to state that it has been observed and abundantly collected the past season (1888), on mountain slopes near Calistoga, where it is associated with *C. foliosus*. It has also been detected from other remote localities, in early botanical collections, so that it is probably of rather extended geographical range. Unquestionably its nearest relations are with *C. papillosus*, the chief points of difference being the absence of papillæ, and a more diffuse inflorescence.

18. *C. papillosus*, Torr. & Gray. To include variety *dentatus* = *C. dentatus*, Torr. & Gray, and variety *floribundus* = *C. floribundus*, Hook.

After extended observation and careful study of *C. papillosus*, where it exhibits its fullest development, in the Santa Cruz Mountains, I am forced to the conclusion that it properly includes the two forms above noted, heretofore regarded as distinct species. When seen in its most luxuriant state on the lower slopes of the Santa Cruz range, it is a densely-branched shrub, 4–6 feet in height, with large oblong leaves (50 x 10 mm.), corrugated on the upper surface, and abundantly garnished with projecting papillæ, tomentose below, and only slightly revolute on the margin. Farther up, the leaves become reduced fully one-eighth the size of the lowland form, and are strongly revolute, almost to the midrib; in this state, the clustered and long pedunculate inflorescence of a deep blue is attractively conspicuous, suggesting at once the published figure of *C. floribundus*, Hook., Bot. Mag., pl. 4,806, but still farther, it also forces the conclusion that *C. dentatus*, Torr. & Gray, is only a form of this species, destitute of papillæ. Before coming to this conclusion, I was led to investigate the true nature of these papillæ, and find that they are only the usual form of glands so commonly met with on the edges of the leaf, where they can most readily break through, while on the upper surface the thicker epidermis usually covers them as protuberances, though not unfrequently revealing their true nature by pushing through, as regular glands. It thus appears that, though a conspicuous character, it is not necessarily constant, or of specific value. As in my view, it is only the absence of the papillæ that separates *C. dentatus* from the reduced forms of *C. papillosus*. I have re-examined an authentic *C. dentatus*, corresponding precisely to the figure in Bot. Mex. Bdy., pl. 10, and find that while surface papillæ are not to be seen, yet the projecting glands at the margins of the leaf are not directly on the edge, but on the revolute folds of the upper surface, so that the essential point of difference is narrowed down to a very small margin. Besides, it is not unlikely that the older herbarium specimens in which *C. dentatus* is generally represented, may have lost the traces of surface glands by age and pressure, a fact which I have been able partly to verify in an examination of old herbarium specimens of *C. papillosus*. On these grounds I feel justified in relieving botanical observers from the care of a vain search for these doubtful forms.

19. *C. impressus*, Trelease, l. c. Coast range, north of Santa Barbara. Known only from imperfect material.

Group V. Integerrimus.

Branches flexible, or spinose in No. 22; leaves oblong or broadly lanceolate, usually smooth, and inconspicuously veined, entire; inflorescence thyrsoid, on leafy peduncles.

20. *C. integerrimus*, Hook. & Am., including variety *parvifolius*, Watson; *C. parvifolius*, Trelease, l. c.; *C. Palmeri*, Trelease, l. c.

From an extended observation of the various forms of this species, through the entire length of California, occupying not only the upper valleys but the higher mountain slopes, I am led to the conclusion that they properly belong to one species, of which it would be possible to make many varieties. The size of the leaf is, of course, unimportant, being easily explained by climatic differences; the leaf venation is also seen to vary from distinctly triple-nerved to obscurely penninerved, while the flower, most commonly white, takes on every shade of faded or bright blue. The most reliable characters are in the texture of the leaf, flexible and inconspicuously veined, the copious and diffuse thyrsus of flowers, on prolonged leafy peduncles, and the fruit, 5–7 mm. broad, and bluntly keeled.

From a photograph of the typical *C. Palmeri*, Trelease, kindly furnished by the author, I have no hesitation in including it as a southern form of this rather polymorphous species.

21. *C. Andersoni*, n. sp. Smooth throughout; branches light green, glaucescent, younger shoots angular; leaves deep green above, entire, oblong-ovate to oblanceolate, cuneate at base to a slender petiole, obscurely penninerved, and paler beneath; inflorescence diffusely thyrsoid, prolonged, leafy below, flowers white, with very slender pedicels; fruit smooth, with thin, resinous exocarp, and rounded cocci.

Habitat:—A tall shrub, 10–15 feet high, loosely branched above, somewhat pendent, the prolonged inflorescence delicate snow-white, flowers in May, fruit July. Santa Cruz Mountains, near Ben Lomond; first collected by Dr. C. L. Anderson, 1887, whose name heretofore so intimately connected with the botany of Santa Cruz, both on sea and land, this attractive species properly commemorates.

22. *C. spinosus*, Nutt. Coast range Santa Barbara, and southward.

Group VI. Microphyllus.

Leaves minute, rather rigid, smooth above, pubescent beneath, irregularly crenate-serrate, fasciculate in the axils, or developing into slender leafy branches; inflorescence terminal or axillary, in small fasciculate umbels.

23. *C. microphyllus*, Michx. }
24. *C. serpyllifolius*, Nutt. } South Atlantic coast.

25. *C. foliosus*, n. sp. Branches slender, divergent, pubescent when

young; leaves somewhat coriaceous, crowded, fasciculate, small—5 to 8 mm. long—ovate, obtuse, narrowed at base to a short petiole, irregularly crenate, with frequent resinous glands, obscurely triple-nerved near the base, not revolute at the margin, but inclined to fold back on the midrib; inflorescence terminal and axillary, loosely globose, or slightly elongated; flowers few, on short pedicels, light blue; fruit triangular, 3–4 mm. broad, sharply crested at the summit.

Habitat:—A densely-branched shrub, 3 to 5 feet high, with light green leaves, more or less resinous glandular; has been referred to *C. dentatus*—included above as a variety of *C. papillosus*—from which it differs in every essential character. In its general features, it comes nearest to the South Atlantic coast species, forming, with them, a well-marked group, approximating the Section following. The specimens seen were collected in the upper Napa Valley, where it is abundant, being associated with *C. Parryi* and *C. divergens*.

B. § Cerastes. Leaves opposite or alternate, persistent for several seasons, rigid coriaceous, entire or spinosely toothed, not glandular, smooth above, with a circular areolate pubescence beneath between the veins; stipules thick, corky at base, with deciduous tips; inflorescence short, fasciculate umbellate, from buds fully formed the previous season; fruit conspicuously crested, with accessory appendages.

Group VII. Rigidus.

Character same as Section. Eight species.

Opposite leaves.

26. *C. rigidus*, Nutt. Monterey, and coast ranges of Central and Southern California.

27. *C. crassifolius*, Torr. Widely spread through the mountain districts of Southern California. Foliage somewhat variable, but general habit quite constant.

28. *C. prostratus*, Benth. Elevated pine ridges of the northern Sierra Nevada.

29. *C. divergens*, n. sp. Branches rigid, divergent, hoary pubescent when young; leaves 10–20 mm. long, 5–10 mm. broad, very rigid coriaceous, cuneate at base to a very short petiole, broadly truncate at summit, with prominent midrib, the principal pinnate veins terminating in sharply mucronate broad serratures, dull green above, with distinct rows of tufted areolar pubescence beneath; inflorescence in short um-

bellate peduncles, occasionally subtended by one or more leaflets; fruit oblong, 5 mm. broad, 8 mm. long, deeply immersed in the rigid disc; exocarp spongy, light pink before maturity, the appendages at the summit of the cocci conspicuously horned, with accessory intermediate crests.

Habitat:—A low-branching shrub, the long divergent branches inclined to support themselves on adjoining bushes, but never decumbent. Flowers in April, fruit July; only known from a single locality in the interesting botanical district of the Napa Valley. Though closely allied to *C. prostratus*, with which, in herbarium specimens, it is easily confounded, it is clearly distinct in habit and foliage, as well as a widely different geographical range. Like all the species of this Section, the explosive character of the capsules is very apparent to any one who would undertake to collect fully mature seeds.

30. *C. cuneatus*, Nutt. Ranging through the entire length of California.

31. *C. Greggii*, Gray. Mexico.

Leaves alternate.

32. *C. megacarpus*, Nutt. Coast range of Santa Barbara.

33. *C. verrucosus*, Nutt. Table-land on the coast of San Diego, into Lower California.

CHORIZANTHE, R. Br.

Review of Certain Species Heretofore Improperly Characterized, or Wrongly Referred; With Two New Species.

BY C. C. PARRY.

(*Presented to the Academy, January 25, 1889.*)

SINCE the revision of *Chorizanthe*, in Proceedings of Davenport Academy of Sciences, Vol. IV., pp. 45–63, an opportunity for examining typical specimens, as well as extended observations and collections in the original localities requires the following changes in the descriptions there given, viz:

13. *C. Douglasii*, Benth. Trans. Linn. Soc. Vol. XVII., p. 418—*C. Douglasii*, Parry, l. c., ex. character—*C. pungens*, var. *diffusa*, Parry, l. c., in part:

Four to eight inches high, branching and assurgent from the base, or erect and simple for the first joint, dichotomous spreading above, hoary pubescent throughout; radical leaves oblong-spathulate, gradually tapering below to a narrow winged petiole, upper leaves short petiolate, passing above to sessile apiculate leaf bracts; inflorescence in small terminal clusters, with crowded acicular bracts; involucres oblong campanulate, slightly contracted near the throat, sharply angled, transversely corrugated between the ribs, teeth divergent, shorter than the tube, membraneous margined to near the uncinate tips, usually light pink; perianth short pedicellate, lobes slightly unequal, erosely denticulate and apiculate, one-third as long as the tube; stamens nine, anthers oblong; akens narrowly-winged, embryo, with narrow cotyledons and short radicle.

Habitat:—Abundant in the valleys of the Santa Cruz Mountains, near Felton and Ben Lomond, in sandy soil, usually low-spreading. Is easily recognized by the purplish acicular bracts, and the lighter pink membraneous margins of the involucre.

What has been in the paper above referred to, designated as *C. Douglasii*, is hereafter described as *C. robusta*, n. sp.

Variety *albens*. Low-branching, 3–6 inches high, of a hoary gray color, the inflorescence albescent, and the expansion of the involucre conspicuously white; not otherwise distinguishable from the typical *C. Douglasii*. Grows in extensive patches in the Salinas Valley, flowering in May.

TWO NEW SPECIES.

21[2]. *Chorizanthe Andersoni:*

Two to eight inches high, densely-branched from the base, spreading, hairy pubescent, joints slender, fragile; leaves mostly radical, oblanceolate, tapering below to a margined petiole, occasional leaf bracts on the lower joints, upper bracts acicular; inflorescence rather loosely cymose; involucres sharply-ribbed, intervals somewhat corrugated, longer segments equal to the tube, alternate one-half shorter, all membraneous winged at base, and with uncinate teeth; perianth short pedicellate, narrowly obconic, lobes spathulate, one-fourth as long as the tube, equal, entire, or short apiculate; stamens nine, on slender filaments, anthers short; akene and embryo similar to allied species.

Habitat:—Scott's Valley, near Santa Cruz, Dr. C. L. Anderson, 1887. Ben Lomond, Santa Cruz Mountains, July, 1888, growing in deep, sandy soil. Differs from *C. pungens* in its slender-branching habit, its usually naked upper joints, and smaller inflorescence. This very distinct species probably includes *C. pungens*, var. *nivea*, Curran, briefly noted in Bull. Cal. Acad. Sci., IV., pp. 3–4.

13². *C. robusta*—*C. Douglasii*, Parry, l. c., not Benth.—Character transferred, ex-*Habitat:*

"Stout, 2–18 inches high, light green, densely pubescent, simple or irregularly-branched above, with one or more foliaceous whorls on the main stem and lower axils; radical leaves, ob-lanceolate, tapering to a narrow petiole; upper involucral bracts acicular, densely ciliate; involucres oblong-triangular, 2–3 lines long, segments unequal, slightly divergent with scarious margins, and short, recurved uncinate teeth; perianth short pedicellate, exsert, lobes nearly equal, shortly mucronate, and erosely denticulate; stamens nine, adnate to the lower tube, anthers oval; style akene and embryo as in allied species."

Habitat:—Dry, sandy soil, margins of Monterey Bay, north of Aptos, Parry, 1883. Sandy banks and streets of Alameda, adjoining the bay, E. L. Green, 1887. Distributed in *Chorizanthe* sets by C. C. Parry, as No. 13, *C. Douglasii*, Benth.

It was not till an opportunity offered of seeing typical *C. Douglasii* in the Gray Herbarium at Cambridge, and the original Douglasian specimens at the herbarium of the Royal Gardens, Kew, England, that I was made aware of my mistake in referring this very distinct species to *C. Douglasii*. Since then I have seen and collected abundantly the genuine plant, in the mountain valleys back of Santa Cruz, undoubtedly the original locality. Owing to the close resemblance in habit and general aspect which the above described species has to *C. valida*, Watson, I was inclined to regard it as a marked variety of the latter, but the floral characters are so distinct that I am obliged to regard the former as an undescribed and well-defined species, to follow *C. Douglasii* as No. 13² in the synoptical list.

Memorial of

David Sylvester Sheldon.

1809—1886.

PROFESSOR DAVID S. SHELDON, LL.D.

BY C. C. PARRY.

(Read before the Davenport Academy of Sciences, at the Memorial Meeting, June 11, 1886.)

HAVING been requested to prepare, for this occasion, a somewhat systematic account of the life and scientific labors of our late associate, Prof. D. S. Sheldon, with special reference to his connection with this Academy, of which he was one of the founders, and its first President, I have endeavored to comply, as far as my limited information goes, premising that this is necessarily an imperfect sketch of a noble character, such as could only be faithfully portrayed by an intimate personal friend, having access to private documents and authentic journals. Such as it is, I desire to lay it before you as at least, a sincere tribute to his memory, and a faint recognition of his sterling qualities as a man, and his endearing features as a friend.

In the early years of the present century (December 6, 1809), among the rugged hills of Vermont, David Sylvester Sheldon first saw the light — the son of a well-to-do farmer, which meant, in that day and place, more than it does in ours, a life of earnest toil and privation, developing faculties of self-reliance, and a sturdy physical frame. With such an inheritance, young Sheldon was also favored with an early scholastic training, such as was then in vogue in the New England Academy, well fitted to impart not only solid learning, but better still, mental development. So we find him, at sixteen years of age, a pupil at Castleton, Vermont, long distinguished, as now, for its wild, romantic scenery, and its elevated educational institutions. That with such surroundings he should have early imbibed a taste for natural science is easily conceivable, even amid the dry abstractions of classical learning and rigid mathematics, which then formed the chief curriculum of study.

So we find him progressing, becoming fitted for college at the age of nineteen, and graduating at Middlebury in his twenty-third year. As was usual in that day, he varied his duties, and, no doubt, economized his means, by teaching in adjoining country schools. And now comes

the important duty of selecting a profession. Quite naturally to a serious and thoughtful mind, the pulpit seemed to present the strongest claims, and accordingly, theological studies are pursued at that distinguished School of the Prophets, Andover. But before the definite step is taken that would have made him what he gained in another direction, a Reverend, the zeal for teaching took possession of his earnest faculties, and, taking up what was then regarded as a lower calling, he devoted his zeal and abilities to raising his chosen vocation to a higher level.

Fifty years ago, the writer, then a school-boy at Bennington, Vermont, had his first acquaintance with Mr. Sheldon, then Principal of the Bennington Academy — hardly a personal knowledge, however, for, unfortunately, I was not a scholar of his, but belonged to a rival school, in which one of the lessons taught was a mean contempt for other institutions. Still, it was apparent to all, that a master mind had the control of the rival academy, and there were certain progressive features there introduced that at least excited our envy, if not our approbation. The impression still remains with me, that for real, solid educational acquirements, the school under Mr. Sheldon was the best.

At that early day, one who has since become noted as a pulpit and platform orator, Rev. E. H. Chapin, was acting as deputy post-master in that village, and occasionally electrified us smaller boys by his dramatic rendition of Lochiel.

And so we parted for a while, only to meet again on the western banks of the Mississippi, almost the *ultima thule* of our early geographies.

Mr. Sheldon is next seen exchanging the green hills of Vermont for the wild chasms of the Saranac in North-Eastern New York, at Potsdam, geologically celebrated by its old red sandstone, one of the lowest of our stratified rocks. Still a teacher, and, no doubt, also a learner, at least the reputation there gained secured him an invitation to the sedate and classical town of Northampton, in the Connecticut Valley. Here, unhampered by jealous rivalry, he threw the whole force of his gifted mind and rich experience into a school distinguished by such scholars as Elizur Wright and others of less note, who continued to look up to Mr. Sheldon as the source of their earliest inspiration.

But, under this mental strain, even the stalwart form of our Vermonter gave way, and, at the age of thirty-nine, he was obliged to seek relaxation in travel; at first, to the south, and eventually to the far west, in Iowa. Coming to Burlington in 1850, then the most prominent

Iowa town, he commenced his pioneer educational work in the west. Here, the heavy hand of affliction was laid on him in the loss of an only child, and soon after, with his stricken life-companion, he came to Davenport, having accepted a professorship in Iowa College. Thus, at the age of forty-four, this place became his permanent home. Here, then, we begin to tread on familiar ground. The sturdy son of Vermont took kindly to the trying climate of Iowa, with its chilling winter blasts and summer heats, the peculiarities of which he made a special study, in connection with a complete set of meteorological instruments, records of which are, no doubt, still accessible. As Professor of Natural Science, one of the important duties devolving upon him was the establishment of a museum, and the times usually devoted to relaxation were largely spent by him in scouring the adjacent country, securing specimens of plants, shells, fossils, etc., which, by an extensive system of exchanges, secured valuable returns from all parts of the world. In connection with this was also accumulated a valuable scientific library.

During the summer vacations longer excursions were undertaken, and the boggy margins of Rock River, in Illinois, yielded up their hidden treasures of *Unio* shells, here in their richest development, but only to be procured by persistent wading and digging. In this way was secured the magnificent series of forms that excited the admiration of Prof. Agassiz, many of which went to enrich the museum at Cambridge, Massachusetts. At that time also, he was associated with Mr. Sereno Watson, then a tutor in Iowa College, in connection with whom a very complete series of local plants were collected, most of which are now stored in the Davenport Academy Herbarium, awaiting the appreciative hand of some young botanist yet to appear from the ranks of the promising Agassiz Club. It is altogether probable that in this congenial employment (in which Mrs. Sheldon took a prominent part), Mr. Watson received his first bent to botanical research, since so efficiently followed up as Botanist of the 40° parallel, and later, as the trusted associate of Prof. Asa Gray, at Cambridge, in the magnificent work of The North American Flora.

So, with our present subject, time moves on — full fifty years have passed over his head, full of cares and labors. Iowa College becoming involved in financial difficulties, is removed, in search of a more congenial location. Prof. Sheldon remains; his hopes still cling to Davenport as an educational center; he becomes connected with another educational institution, under the auspices of a different denomination of Christians, with whom, in a true catholic spirit, he unites, and again

assumes educational work, as professor in Griswold College. Engaging in multifarious duties; successful always in securing the affectionate regard of his pupils, giving up not only his time and abilities, but also his means to build up an institution approximating his high ideal, can we wonder that disappointment weighed heavily upon him in seeing his long-cherished plans unconsummated?

It was at this juncture, when Prof. Sheldon had nearly reached his sixtieth year, that the Davenport Academy of Sciences was organized. He was urgently requested to accept the presidency, but only consented on condition of being relieved from nominal official duty as its presiding officer. Since then, up to the last week of his life, he has been our trusted counsellor, our constant supporter, and our ever faithful friend. Whenever a word of encouragement was needed, his earnest voice was at our command; when funds were urgently required, his hand was stretched out unstintedly to our relief. Even now, in our profound sorrow for his loss, his benignant face beams on us from that precious sun-picture, saying, "BE OF GOOD CHEER!"

With what sad recollections do we recall the meeting of only two weeks ago, when, for the last — and, I might almost say, for the first time at our regular meetings — his voice was heard, in advocacy of what he considered a question of importance to the well-being of this Academy, in scathing rebuke of unjustifiable assaults on its integrity; in words of encouragement to us, who, in our feeble way, have endeavored to uphold the torch of science — memorable words, to be sacredly bequeathed to those that come after us.

It has seemed necessary to go over all this preliminary matter, in order to reach our main point, in a proper appreciation of the scientific work and character of our late associate.

Prof. Sheldon became what he was, as the combined results of his birth, his early education, and his enlarged experience. Thus, to his natural inherited gifts were added acquired virtues, all enriched by those eminent Christian graces that added a winning lustre to his personal character. Not but what he had his failings. I think it is a proper matter of regret to us all that instinctive reluctance to anything like public display prevented him from the wider exercise of his talents by giving to the scientific world, in printed form, the results of his observations and researches; his name does not appear in any of our published reports. Well do I remember an early conversation with him, in which I ventured to urge such a matter on his attention. His answer was characteristic: "That is not my vocation; *I can teach.*"

What answer could I make, when I knew that his most earnest thoughts were being printed daily on the living tablets of the hearts of his pupils, only to appear in distant results, in which the hand of the master is known only to the All-seeing Eye?

In matters pertaining to his avocation as a teacher, Prof. Sheldon's memory could be safely relied on, but to such things as related only to his personal interests, he was, at times, strangely oblivious. A characteristic instance in point will well illustrate this phase of his character: A bank deposit, to his credit, of no small amount, was allowed to accumulate for years, till the interest greatly exceeded the principal. When accidentally informed by one of the bank officials that there was such a sum to his credit, he could hardly be convinced of its truth, so completely had the whole transaction passed from his recollection. Similar instances of forgetfulness, where the debit account is on the other side, are unfortunately not rare; but, in this case the only explanation was in the man — it was Prof. Sheldon literally carrying out the Scriptural injunction of not letting his left hand know what his right was doing.

Most of us will remember the long shaggy-haired dog which, for so many years, was the constant companion of his daily walks. To many it seemed rather a strange attachment for a learned professor, but admits of a ready explanation. However wide apart in other respects, in both the character of friendliness and faithfulness was plainly exhibited; the dog knew that his master could be trusted to do what was kind and generous, and the master knew that a look or a sign was sufficient to enforce the strictest obedience. There was thus a bond of union established that terminated only with life.

Not in this instance alone was his natural taste exhibited in an affectionate study of animal life. At an early day in his Davenport career, in one of his rambles, he made captive a nest of flying-squirrels, and no captives ever fared better at the hands of the capturer. He at once (assisted, as in all his schemes, by his faithful wife), undertook a careful study of their habits, provided every convenience of shelter, food, and exercise for their comfort and well-being, nursed the young with his own hands and was rewarded in seeing them thrive and enjoy life under his watchful care. Soon unbounded trust took the place of instinctive fear, and they indulged their nocturnal sports in his presence, darting from place to place, but most at home when nestling in his sleeve or bosom; in fact, they would not object to make that their daily resting-place. As a matter of historic interest, it may be added that, in the

case of one of these captive pets, life was prolonged to the ripe old age of twelve years, and the same fatherly hand that nursed its infancy daintily prepared its skeleton, which now graces the Academy's collections. If now, Prof. Sheldon had only given us, in the simplest way, the information thus gained of the life-habits of these curious and obscure denizens of our woods, we should have had a gem of Natural History worthy the pen or pencil of an Audubon or Thoreau. But, alas! such information has now gone beyond our reach.

Better than all this, however, though in the same line of research, was his earnest life-study of humanity; from the obscure pages of ancient lore, in which he was well versed, he ever turned with delight, to "read that hidden book, the human heart." He studied, with ever-increased interest its manner of growth and its manifold development, never so happy as when seeing it take a wise direction, under his plastic hand. His pupils soon learned to know and recognize his power for good, and yielded to his persuasive influences; the bad were reformed, the perverted turned from their evil courses, and all that was generous, noble, and manly brought up to its full measure of excellence.

Pity that a mind so gifted, a character so ennobled, and an ability for usefulness so exalted, should not, for want of proper appreciation, have been allowed full scope for its exercise! Great pity, that disappointment in the apparent failure of his educational schemes for this, his chosen home, should have dimmed the evening of his beneficent life! With what satisfaction would those who knew him best, and, therefore, loved him most, have seen him occupy, for many years, the pleasant home erected under his own auspices, and displaying his own delicate and refined taste; his simple, every-day wants supplied by the gentle hand that had been reared under his fostering care from childhood; attaining to a green old age, surrounded by the substantial evidences of a well-spent life, and cheered by the affectionate gratitude of those who had reaped the benefit of his labors, or were made better by his wise example. But, from a higher than human source came, too soon for us, but not for him—June 5, 1886—the blessed summons: "Well Done, Good and Faithful Servant;"—faithful alike in few or many things—"Enter Thou into the Joy of Thy Lord!"

CEANOTHUS, L.

Recent Field Notes, with a Partial Revision of Species.

BY C. C. PARRY.

(*Read before the Academy, August 30, 1889.*)

In undertaking to put into systematic form the results of some special observations on the genus *Ceanothus*, included in Proceedings of the Davenport Academy of Sciences, Vol. V., pp. 162–174, the common experience of finding a lack of definite information on certain important points was naturally encountered. With a view to meet some of these in the only effectual way, the writer was induced to undertake, the present season (1889), a brief re-exploration of certain districts on the Pacific coast, affording the best promise of successful results in elucidating the doubtful points needed to clear up certain specific characters. It is always an advantage in such researches to have some definite object in view, some special doubtful questions to answer; and with these weighing on his mind, the writer felt at liberty to pass over with a mere cursory view, such matters, however interesting, that did not bear directly on the main object of investigation.

To acquire a satisfactory knowledge of the earlier-described Pacific coast species, often described from imperfect fragmentary material, it is desirable, if possible, to visit the original localities and identify the types with the living plants, thus not only settling the vexed question of synonomy, but supplying what is wanting in a complete definition of species. It has so happened in the nature of the case, that the earliest botanical explorations were mainly confined to a few accessible points on the Pacific coast, from which only a limited area of the vast interior districts could be reached, amid hardships and privations difficult to realize under the facilities of modern travel. Hence, peculiar interest attaches to such localities as the mouth of the Columbia River, the harbors of Monterey, Santa Barbara, and San Diego, rendered classical by the enthusiastic labors of Chamisso, Douglas, Nuttall, and others of less note. Treading reverently in the steps of these worthies of a past generation, as others may do later in ours, the writer enjoyed

a few days in the latter part of this season (1889), just forty years from his first acquaintance with this locality, in the modern San Diego, climbing leisurely over the then verdant hills, and threading his way amid the same maze of shrubbery through which Nuttall had struggled over fifty years ago, bringing first to the notice of Eastern botanists the floral features of this far Pacific coast, in the volume of the North American Flora. The genus *Ceanothus*, which he then enriched with so many peculiar West-American species, was here represented mainly by *Ceanothus verrucosus*, Nutt., which, though at the time of his short visit in April and May was past flowering, yet revealed to his practised eye its peculiar specific qualities. Though at the time of my visit the flowers had mainly disappeared, yet having previously observed it in all its stages of growth, it was unmistakable, being especially distinguished from the nearest related *C. rigidus* in its more supple, often somewhat pendent branches, its white or faintly tinged blue flowers, its alternate leaves, and the more strongly marked protuberances on the lower branches left by the fallen leaves, and persistent stipular bases. The figure, Pl. IX. in Mex. Bdy. Survey, referred to *C. rigidus*, is, as suggested by Professor Trelease, undoubtedly *C. verrucosus*, Nutt., which, by a misplacement of labels, is credited to "Monterey, Parry." As far as now known, this species is confined in its geographical range to San Diego, extending southward into Lower California. It can in no way be confounded with the widely spread *C. cuneatus*, Nutt., the points of distinction being clearly laid down in the original description.

Reversing the order of Nuttall's journey from north to south in 1836, the writer spent the first week of April in the picturesque Ojai Valley, near Santa Barbara, probably covering the same time of year as Nuttall fifty-three years before. Previously I had received from General John Bidwell and wife, then wintering at this sanitary retreat, some intimation of the floral features of this locality. It was, therefore, a rare treat to avail myself of their extended observations in driving over the adjoining country as their guest. Though rather late to see in its perfection the full development of inflorescence of the different species of *Ceanothus* there represented, it was particularly pleasant to think that Nuttall had made his observations of these plants about the same time of year, in a closely adjoining district.

Foremost of these to attract attention was the luxuriant *C. spinosus*, Nutt., here attaining the size of a small tree, 15 to 20 feet in height, and with trunks not infrequently 8 inches in diameter. Though low-branched and usually of scrubby growth, it is here sufficiently abundant

to be cut for fuel, showing a dense cherry-red heart-wood, from whence it has derived the common name of "red wood." Its inflorescence is copious, on prolonged thryses, the flower of a light faded blue, the forming fruit scarcely lobed, and strongly resinous coated.

In a systematic point of view, special interest attaches to the species from this locality first described by Nuttall as *C. hirsutus*. While easily recognized from the description in this, its original locality, it has been confused in points farther north and south by an erroneous reference to *C. sorediatus*, Hook. & Arn. Being particularly anxious to clear up, if possible, this confusion, the species has been traced as far as practicable in its southern extension with the conclusion since fully confirmed, that all the southern forms belong to *C. hirsutus*, and while not as yet fully informed as to its northern range, I am of the opinion that it does not overlap or mingle with the true *C. sorediatus*, the character and range of which latter I am now able, as will be shown farther on, satisfactorily to define. It must suffice at present to offer the following notes on *C. hirsutus* as seen in its original locality:

C. HIRSUTUS, Nutt., Fl. N. Am., I., p. 266. Four to twelve feet in height, branches spreading, rather slender, light brown on the older stems, occasionally covered with small glandular warts, younger branches strongly hirsute; leaves ovate to broadly cordate, petiolate, finely glandular-serrate, dark green above with more or less hispid pubescence, paler beneath with conspicuous triple and intermediate veins, hispidly ciliate; flowers bright or light blue, inflorescence more or less prolonged; fruit rather conspicuously crested, 4 mm. broad. As seen in its southern range, extending into Lower California, it occasionally assumes an arborescent aspect. According to the views of Mr. Brandegee, *C. arboreus*, Greene, would represent the insular form of this species, though few may be willing to accept his conclusions.

Another typical Santa Barbara species is *C. divaricatus*, Nutt. This is one of the most easily recognized species, varying in size from a low bush to a medium sized tree, with light colored glaucous bark, rigidly spinose branches, light green leaves, usually entire, but not infrequently, especially on vigorous shoots, irregularly serrate, inflorescence diffuse, flowers dull faded blue; fruit orbicular, with scarcely any protuberances. It may be here remarked that the swollen protuberances appearing as lobes or crests on the back of the *cocci* are always most conspicuous on the young forming fruit, which shrink away more or less at maturity. The accessory intermediate appendages common in the *Cerastes* section often persist as projecting horns.

My investigations in this interesting vicinity were not sufficiently early in the season or extended in range to meet with *C. megacarpus*, Nutt., the peculiar floral characters of which not coming under the notice of Nuttall, have been noted by Professor Greene in Bull. Cal. Acad., III., pp. 80–81. The change in nomenclature from *C. macrocarpus*, Nutt., to *C. megacarpus*, Nutt., though clearly stated by Nuttall himself (Nutt. Sylv., II., p. 46), has, strangely enough, not as yet been taken up by recent systematic writers. As the validity of the earlier *C. macrocapus*, Cav., of Mexico, is admitted (Hemsley's Biol. Cen. Am., I., p. 199), there remains no valid reason for not accepting the necessary correction which, though merely verbal, sufficiently distinguishes the separate species.

C. IMPRESSUS, Trelease, from the Santa Ynez Mountains, did not come under my observation. Though imperfectly known, its well-marked characters seem sufficiently to distinguish it.

Reaching Oakland in mid-April, pleasant and commodious quarters were kindly offered as a guest in the botanical eyrie where the Lemmon Herbarium is located. Here, overlooking the busy, bustling town, above its noise and dust, the verdant slopes encircling the bay of San Francisco presented ever-attractive views. In the latter days of March, Professor Greene had gathered from Mt. Tamalpais luxuriant flowering specimens of a *Ceanothus*, which I soon recognized as the species which, from imperfect material, I had characterized as *C. intricatus*, Parry, l. c. To my surprise I also found, through Mr. Greene, that the same species had been in cultivation for several years in the private grounds of Professor Rivers, at Berkeley, as well as the University Botanic Garden. So that the material for clearing up this species seemed close at hand, without requiring the climb to the summit of Mt. Tamalpais. It also suggested a strong probability, since verified, that this might more properly belong to an old established species. In order to verify the original facts, however, I visited the lower slopes of Mt. Tamalpais on April 30th, finding the species fairly represented, then in forming fruit, while at the same time the mountain slopes were brilliant with the profusely clustered thyrses of *C. thyrsiflorus*, Esch. Not allowing this elegant display to distract my attention from its lowlier compeer, which, a full month before had its flowering season, thus obviating any risk of confused forms resulting from hybridization, I note herewith the characters then and subsequently observed, postponing till later the question of its systematic relations, viz.:

A densely-branched shrub, 3–8 feet in height, light or reddish-gray

bark, occasionally covered with patches of resinous warts, younger branches with a short, appressed pubescence, mixed with longer, scattered hairs; leaves short-petiolate, elliptic to ovate, 20–30 mm. in length, 10 mm. broad, much smaller on the secondary branches, smooth above, in the fresh-growing shoots coated with a light varnish, finely ciliate-glandular, rarely in vigorous shoots crenately margined, paler beneath, with ciliate hairs on the veins, distinctly triple-nerved; stipules rather rigid, and often covered with an adhesive resinous varnish; inflorescence more or less prolonged beyond the leaves, compactly oval or loosely thyrsoid, flowers bright blue; fruit 4 mm. broad, smooth, without crests. In cultivated specimens where the growth is prolonged by irrigation, the dense branches with their deep green, glossy foliage form neat, compact clumps, fully justifying the proposed name of *intricatus*.

It was reserved for a quiet closet retreat, 2,000 miles from its place of growth, to determine the true systematic relations of this species, and correct the synonomy. Being particularly desirous to settle definitely the early described species, *C. sorediatus*, Hook. & Arn., I applied by letter to Professor Watson, at Cambridge, Mass., and also to the Herbarium of the Royal Gardens, at Kew, England, for any fragments that might be spared of the typical Douglasian specimens. With the usual courtesy, I was favored with two leaves from Cambridge, and a somewhat larger fragment from Kew, kindly supplied by Mr. J. G. Baker, of that world-renowned institution. I at once recognized that these specimens were identical with the plant above described, and that the *C. intricatus*, Parry — fortunately not widely distributed — should be reduced to a synonym of *C. sorediatus*, Hook. & Arn.

Having thus clearly and satisfactorily defined the true *C. sorediatus*, Hook. & Arn., also determining its proper geographic range, not apparently extending far south of San Francisco Bay, it became necessary to re-examine the various forms which had been erroneously referred to this species. The suggestion of Professor Trelease in his recent notes on *Ceanothus*, that probably "one or more species may ultimately be separated" from the diverse plants included under *C. sorediatus*, Hook. & Arn., by more recent authors, must here receive verification.

Thus, the specimens from the Upper Sacramento Valley, at Ione, which, in my recent paper, I took to represent the typical *C. sorediatus*, Hook. & Arn., and sparingly distributed under that name, proves to be the first one calling for separation. As this can be quite satisfactorily

identified from the description with *C. azureus*, Kell., Proceed. Cal. Acad., I., p. 55 (1855), and from actual specimens of Bolander, No. 4,558, *fide* Watson (4,548 Herb. Cal. State University), I am obliged to regard it as a well-marked, undescribed species, and, being precluded from the use of personal names in the fact that it had passed through the hands of several collectors under different names, I herewith characterize, viz.:

C. TOMENTOSUS, n. sp. *C. sorediatus*, Parry, l. c., not Hook. & Arn. Character transferred and enlarged.

Four to eight feet in height, with slender branches light gray or reddish, younger shoots densely rusty-tomentose, deciduous on the older branches; leaves short petiolate, sparsely scattered on the branches, with short fasciculate branches in the axils, oval to sub-cordate, 10–25 mm. in length, dull green, smooth above, tomentose beneath, strongly triple-nerved from the base, irregularly and coarsely glandular-serrate, occasionally sub lobed; inflorescence compact or oval, on short or more or less prolonged peduncles, flowers intense azure; fruit 3 mm. broad, with inconspicuous crests at maturity.

Habitat:—Known to the writer only from the brown sandstone ledges of Ione, Amador County, associated with *Arctostaphylos myrtifolia*, Parry, flowering in March, fruit in May.

The necessary changes in the synoptical list, Parry, l. c., will be indicated in the systematic summary at the close of this paper.

On revisiting the always attractive botanical locality of Monterey, so replete with historical associations, I lost no time in exploring the brushy wastes north-east of Hotel del Monte, near where, in 1850, I had collected the typical *Ceanothus dentatus*, Torr. & Gray, from which specimens was drawn the excellent figure, Plate X., Bot. Mex. Bdy. Survey. In my recent paper, Proceed. Dav. Acad., V., p. 171, I had been inclined to discredit this species, regarding it as a reduced form of *C. papillosus*, Torr. & Gray, without the papillæ. But here on the ground, while still fresh from a view of *C. papillosus* at its near home in the Santa Cruz Mountains, the question was soon to be settled. So, in struggling through a thicket of *Adenostoma*, my eye was attracted by a low-branching shrub, with crumpled, varnished leaves of a yellowish-green aspect. This, on closer inspection proved to be the genuine *C. dentatus*, probably from the original locality whence Douglass procured his specimens. It did not take more than a glance (though I had made many before on dried specimens) to show that it was clearly distinct. Much of the confusion that has heretofore attached to this species is

due to the fact that the published descriptions since the original, Torr. & Gray, N. Am. Fl., I., p. 268 (which is clear enough except in the statement of flowers being white), have been made to cover at least two very distinct species, especially the one I have recently distinguished as *C. foliosus*, Parry, l. c.

At the time of my visit, May 12, it was already past flowering, except some belated shoots which belonged rather to a second forced growth the present season. In these the bright blue color was conspicuous, but there was lacking the prolonged peduncle of the regular flowering season. This fact suggests an explanation that would seem to justify the proposed union of *C. floribundus*, Hook., with *C. dentatus*, Torr. & Gray, the former being known only in cultivation, and mainly distinguished from the latter in its condensed inflorescence, which may reasonably be regarded as due to the widely different condition of cultivation in a remote district.

From detailed notes then made on the spot, as well as a subsequent visit six weeks later, the following additional *data* are herewith given as representing the genuine C. DENTATUS, Torr. & Gr.:

Three to four feet in height, densely-branched spreading, with reddish bark on the older stems, inclined to be angular on the younger shoots by the decurrence of the petioles; leaves short petiolate, densely fasciculate in the axils, variable in size, 10–25 mm. in length, oblong ovate in outline, by the strongly revolute margins and inflexed tip assuming a truncate wedge shape, smooth, light yellowish green above, canescent hairy below, with strongly pinnate veins, irregularly toothed, tipped with conspicuous stalked glands; stipules conspicuous, often coated with a resinous exudation; inflorescence terminal, globular, on prolonged peduncles, or in premature shoots later in the season showing a prolonged leafy spike; fruit 4 mm. broad, distinctly crested, the resinous coated epicarp deciduous at maturity. Flowering in March, fruit in May.

In the latter part of May, and early June, a trip was made to the Upper Sacramento, with a special view to study the different phases of the somewhat variable but easily recognized *Ceanothus integerrimus*, Hook. & Arn. The results helped to confirm the view previously expressed in regarding all the forms so widely spread through the mountain districts of California as properly belonging to a single somewhat variable species. Thus, in passing over the country in various directions at lower or higher elevation, it was everywhere noted as a graceful, slender-branched shrub, displaying its more or less prolonged thyr

soid inflorescence in every shade of color from pure white to faded or bright blue. In passing to a higher elevation the flowering period was correspondingly delayed, so that even in a short day's journey the plant could be seen in every stage of growth, from bud to forming fruit. The tendency was also manifest to assume smaller forms at the higher points, thus corresponding to the variety *parvifolius*, Watson. It may also here be noted that even the entire leaved character is not constant, as vigorous shoots show not infrequently irregular serratures. In the same connection it may also be stated that seedlings of other entire leaved species are deeply and sharply serrate. But these observations, important for the time being, became secondary in interest to the study of another species on the rocky slopes of the Upper Sacramento, which could not properly be referred to any described form. Copious notes and collections then made confirmed this view, and subsequently the same species turned up in collections made by Mr. and Mrs. Lemmon in Plumas County the present season. Professor Lemmon, in sending specimens with accompanying notes in a letter, stated that he had collected the same as early as 1874. It was then passed over hastily at Cambridge as a mountain variety of *C. thyrsiflorus*. Mr. Lemmon, not satisfied with this determination, re-collected and examined more carefully on his recent trip to the Sierras, and, our views coinciding on its specific character, with his consent I take pleasure in commemorating a long and pleasant botanical association by naming as Ceanothus Lemmoni, n. sp.:

Two feet high or less, spreading with rigid branches, bark lightish gray, more or less hairy pubescent on the younger stems; leaves narrowly elliptic to oval, 10 to 25 mm. in length, smooth above, ciliate pubescent on the veins beneath, glandular-serrate, the serration most distinct on young, vigorous shoots; stipules somewhat rigid; inflorescence short on prolonged leafy peduncles, flowers of a bright or faded blue color; fruit 4 mm. broad, conspicuously crested.

Habitat:—Johnson's Ranch, near Quincy, Plumas County, Lemmon, 1874—May 30, 1889. Rocky slopes of the Upper Sacramento Valley, 1888–89, C. C. Parry.

In herbarium specimens this species has probably been heretofore referred to *C. procumbens*, Watson, from which it differs essentially in its rigid habit, its less expanded foliage, and different form of fruit. On the ordinary travelled route to the Yosemite, where *C. procumbens* is conspicuous, spreading over the ground a soft carpet of verdure, the

ordinary traveller — much less the observing botanist — would find little difficulty in recognizing the distinction, whether by foot or eye.

In conclusion of the above rather desultory notes, though recording the results of careful, conscientious observation, it may be well to present the following condensed summary:

SYSTEMATIC SUMMARY.

CEANOTHUS SOREDIATUS, Hook & Arn., Bot. Beech., p. 328.

———— ————, Torr. & Gray, N. Am. Fl., I., p. 686.

———— ————, Watson, Proceed. Am. Acad., X., p. 336, excl. Bolander, No. 4,558.

———— ————, Trelease, Proceed. Cal. Acad. Sci., 2 series, p. 111, excl. geographical range.

C. intricatus, Parry, Proceed. Dav. Acad. Sci., V., p. 168.

To be included in synoptical list, Parry, l. c., as No. 9, p. 168, in place of *C. intricatus*.

CEANOTHUS TOMENTOSUS, Parry. See page 190.

C. azureus, Kell., Proceed. Cal. Acad., I., p. 55.

C. sorediatus, Watson, l. c. in part, Bolander 4,558–(4,548)?

———— ————, Parry, l. c., not Hook. & Arn.

In synoptical list, Parry, l. c., to follow *Ceanothus hirsutus*, Nutt., as No. 15^2. In group III., substitute HIRSUTUS for SOREDIATUS.

CEANOTHUS LEMMONI, Parry. See page 192.

In synoptical list, Parry, l. c. to follow *C. decumbens*, Watson, as No. 4^2.

CEANTOHUS DENTATUS, Torr. & Gray., N. Am. Fl., I., p. 268.

C. floribundus, Hook., Bot. Mag., t. 4,806.

———— ———, Watson, l. c., p. 338.

C. dentatus, sub-sp. (?) *floribundus*, Trelease, l. c., p. 112.

C. papillosus, var. *floribundus*, Parry, l. c., p. 171.

———— ———, var. *dentatus*, Parry, l. c., pp. 170-71.

CEANOTHUS ORCUTTII, Parry. See note page 194.

The restoration of *Ceanothus dentatus* with the additional new species, *C. tomentosus*, *C. Lemmoni*, and *C. Orcuttii* increases the number of species in synoptical list, Parry, l. c., to 36, or, excluding Mexican species, to 33.

NOTE.—Since the completion of the above paper, I have received fruiting specimens of the following, viz.:

CEANOTHUS ORCUTTII, n. sp.

Branches flexible, dull reddish, with short, hispid pubescence; leaves petiolate, broadly orbicular to oblong-cordate, usually rounded obtuse, 30 to 40 mm. in length, often as broad, irregularly glandular-serrate, sparingly hispid above, strongly triple-nerved beneath, with prominent hairy ciliate veins; inflorescence axillary, oval scarcely exceeding the leaves, rather compact, with pubescent rachis, and smooth pedicels; flowers apparently white or light blue (seen only in fallen fragments); fruit glandular-hispid, with corrugated resinous epicarp, and conspicuous crests; seeds light brown.

Habitat:—High mountains east of San Diego, C. R. Orcutt, May and July, 1889. Remarkable for its glandular-hispid fruit, nearest allied to *C. sanguineus*, Pursh., and to succeed it in the synoptical list as No. 3^2.

SYNOPSIS OF PROCEEDINGS

OF THE

Davenport Academy of Natural Sciences,

1885—1888.

[In this abstract of the proceedings of the Academy the records of routine and unfinished business or unimportant matters are omitted.]

January 7, 1885.—ANNUAL MEETING.

President Fulton in the chair; twenty-nine members and a number of visitors present. Report of officers postponed to next meeting.

On motion of Hon. George H. French the following resolution was adopted:

Resolved, That the best interests of the Academy require that only the interest accruing from the Endowment Fund and any bequest that the Academy may receive, shall ever be used by the Trustees for current and other expenses.

ELECTION OF OFFICERS.

President—C. E. PUTNAM.
First Vice-President—C. E. HARRISON.
Second Vice-President—J. B. PHELPS.
Recording Secretary—Miss LUCY M. PRATT.
Corresponding Secretary—W. H. PRATT.
Treasurer—W. H. FLUKE.
Librarian—Dr. JENNIE MCCOWEN.
Curator—W. H. PRATT.

Trustees for Three Years.—Dr. E. H. HAZEN, T. W. MCCLELLAND, C. E. HARRISON, WILLIAM RIEPE.

On motion of Rev. A. M. Judy, the following resolution was adopted:

Resolved, That one hour of the regular monthly meeting be devoted to scientific discussion.

January 30, 1885.—Regular Meeting.

President C. E. Putnam in the chair; fifteen members present.

Deferred reports were presented as follows:

The annual report of the Treasurer, Mr. W. H. Fluke, shows the receipts during the past year to have been $870.08; expenditures, $839.87; leaving a balance in the treasury of $30.21, which, together with the Endowment Fund, leaves a total balance of $896.95.

L. M. Pratt's report, Recording Secretary, develops some interesting figures. There was an average attendance of eleven. Five opera house entertainments were given under the auspices of the Academy, and Washington's birthday was observed. Total regular members, 150; life members, 79; elected during the year, 10. There were 1,974 paying visitors to the Academy, 1,017 visiting members, and 1,507 visitors by invitation, business calls, etc., making a total of 4,498.

CURATOR'S REPORT.

To the Davenport Academy of Natural Sciences:

In regard to the condition and progress of the Academy museum for the past year I would respectfully report:

The principal accessions to the archæological department consist of the contents of twenty-three boxes and barrels of relics from the southern mounds, collected and forwarded by Capt. W. P. Hall. The relics are principally ancient pottery, a large portion of which is secured in a fragmentary condition. The broken vessels have been partially restored, leaving considerable work to be done to complete it.

The collections of the year comprise over two hundred earthen vessels, including a very considerable variety of forms. The most of these are packed away for the present, as the cabinet cases are fully occupied and none have been added during the year. With the pottery came a variety of stone, flint, and bone implements, and nine mound skulls in fair condition. The collection of human crania now number 124 well-preserved specimens. A small collection of flint, agate, and bone implements has also been received, collected during the summer on the site of an old Maundon town near the banks of the Missouri River, at Le Beau, Dakota. No explorations of mounds in this vicinity have been made by the Academy or its members except some work by Rev. J. Gass, in the north-eastern part of the State, which is described in a paper from him presented at the December meeting.

In the natural history department eight stuffed birds have been presented by Dr. S. C. Bowman, and a stuffed alligator, half-grown, a fine specimen, by D. J. W. Viele.

Mr. H. A. Pilsbry has collected several species of aquatic shells new to this locality, and he has prepared a catalogue, now nearly completed, of the whole collection of shells in the museum.

In geology and palæntology, Professor Barris has contributed some new species, described in papers recently published.

Rev. J. Gass forwarded a box of Silurian fossils from Allamakee County, and M. A. L. Mueller, of Sioux City, contributed an interesting limestone fossil, undetermined, from that locality. The historical department has received from Dr. E. S. Barrows the likenesses of several of the early settlers of this city, and a considerable number of interesting relics have been added by various contributors. On the whole, the growth of the museum has been rather less than during several preceding years, and this is due to want of a sufficient number of active working members; want of funds for prosecuting researches and preparing specimens, and want of cases in which to arrange what is acquired. Nearly all the available space for cases in the building is now occupied. We could, however, put in the basement four or five similar to those already there, and they would be very desirable for collections in local and systematic geology and mineralogy, which are very much needed. With such collections we could interest and aid the pupils of the high schools of this and the closely adjacent cities, and their hitherto occasional visits would become more frequent and regular. This requires more means, and especially more attention. A good foundation has been laid and a great deal of earnest, effective work done, but the whole is incomplete. The opportunity is a grand one for building up an institution which shall be a constantly growing stimulus and aid to studies in natural science, and to public education. To do this will require not only continued but greatly increased active membership and active support on the part of the community at large. For the development of earnest and thorough students and workers in practical science, much is to be hoped from such organizations as the Agassiz club of young men, which is now holding regular meetings here, and every effort should be made for the encouragement of that and similar associations.

LIBRARIAN'S REPORT.

Mr. President:

I have the honor to report that during the year there have been one thousand five hundred additions to the library. We have received, in exchange for our Proceedings, the proceedings and publications of one hundred fourteen scientific institutions and societies of this country, and of one hundred ten foreign institutions; almost all the government reports; all the state public documents; twenty monthly journals, chiefly scientific; sixteen weeklies, chiefly agricultural and mechanical; five general newspapers in addition to the city dailies, together with about one hundred transient papers containing articles of scientific or archæological interest. Additions of value have been made under the heads of Physics, Astronomy, Meteorology, Geology, Mineralogy, Botany, Entomology, Archæology, Anthropology, Agriculture, Education, Biography, and History.

In order to make this really valuable collection available, more shelf-room is necessary. Some preliminary steps have been taken in regard

to cataloguing, and it is hoped that the ensuing year may find something accomplished in this direction.

In order to render the large number of scientific, agricultural, and mechanical journals and papers useful to the community and to the society, I would suggest the propriety of placing them on file in one of the lower rooms, where they may be available for reference.

All of which is respectfully submitted.

JENNIE MCCOWEN, M.D., *Librarian.*

PUBLICATION COMMITTEE'S REPORT.

MR. PRESIDENT, LADIES, AND GENTLEMEN:

Never since the inauguration of the publication of the Proceedings of the Davenport Academy of Natural Sciences, in 1875, has the outlook been more encouraging than at the present time, or a deeper interest taken in the work, both at home and abroad. Applications for the previous volumes are constantly received, while exchanges have continued to come from almost every known scientific society in the world.

Volume IV. is a direct outgrowth of a list from Professor W. H. Holmes, in September, 1883, through whom the Bureau of Ethnology made an offer to publish wood cuts of all the most important pieces of pottery in the Museum of the Davenport Academy of Natural Sciences for our own publication, afterwards using the same cuts for the volume of the Smithsonian report. The Academy at a formal meeting accepting this offer, your committee were instructed to proceed with the work, and raise the necessary funds by subscriptions to Volume IV., donations, and entertainments.

The first form of Volume IV. came from the press November 18th, 1883, and form 13, page 120, December, 1884.

Over one-third of Volume IV. is completed, and about one-third more in press. It is proposed to close this volume with a synopsis of the records of the past four years ending with 1884.

MRS. M. L. D. PUTNAM, *Chairman.*

PRESIDENT'S ANNUAL ADDRESS.

BY H. C. FULTON.

LADIES AND GENTLEMEN:

Upon retiring from the office of President of the Academy at this, the close of my term, I wish to call your attention to the present condition of the institution, and make a few suggestions. The year past has not been one of remarkable growth for the Academy, but has been one of progress, and the reports show the institution to be in better condition to-day than ever before. Meetings have been regularly held throughout the year, and the attendance has been good, though there has been a failure to make them of sufficient interest, and too much time has been consumed in the routine business of the

Academy, and not enough given to scientific study and discussion. This fault should be corrected, and provision made to give interest to the meetings, and make them a means of scientific study. One step in this direction (and one which has been before suggested), is to provide for the discussion, at each meeting, of some topic of scientific interest, and in this way stimulate thought and research, and make the Academy what it is intended to be — an educational institution. The Curator's report shows a steady growth in all departments of the Museum, though not so great as during many other years. It is to be regretted that we lack shelf space to properly exhibit much valuable material which is now packed away, and as the present cases are now filled to their utmost capacity, and almost all case room utilized, there seems to be no way out of the difficulty excepting to erect the proposed front of the Academy building, and it is to be hoped means may be provided at an early date to provide a fund for this purpose.

The Publication Committee has performed much labor in the past year, and has now in preparation and in hand some of the most important and valuable work ever attempted in this department of the Academy, for the particulars of which you are referred to its report. The importance of our publications demands that it should be continued so far as means can be provided, and that its compilation embrace papers only of scientific value, with such matters of Academy details and business proceedings as are absolutely necessary. As our publications go into all civilized countries, and have done so much to inform the world of our work, and thus add to the Academy's reputation and to its wealth through exchanges and acquaintance, they should be placed on a high scientific and literary basis, and be ably and carefully edited. Through the instrumentality of our publications has the library been largely added to, as shown by the Librarian's report. The demand for more library room, binding of serials and pamphlets, and a complete catalogue is very pressing and should be provided for as early as possible — particularly the catalogue, on which depends, to a great extent, the value of the library.

The report of the Treasurer makes a most gratifying showing; the receipts of the year being sufficient to pay all expenses, and, with the dues yet unpaid and collectible, sufficient to cancel the indebtedness carried over from 1883. The Treasurer's books show a large sum due the Academy, but uncollectible, and the same should be charged to profit and loss, and the members delinquent in their dues stricken from the roll of membership. The financial showing is very encouraging when it is remembered there have been no extraordinary receipts during the year, excepting about $250 received from the lecture course of last winter, which was the only appeal made to the public.

The Endowment Fund of the Academy is now about $1,000, and will shortly be increased $250, by the bequest of the late Robert McIntosh. I heartily concur in the resolution adopted at the last annual meeting, declaring it to be the desire of the Academy that all endowments should be held inviolate, and only the interest used. The future prosperity of the Academy will, to a great extent, depend upon endow-

ments, and every effort should be used to encourage the growth of that fund, by sacredly preserving it, that it may yield interest, which, it is hoped, will in time pay the running and working expenses of the Academy. "To him that hath shall be given," and a growing endowment fund will draw and increase to itself.

The increase in membership during the past year has not been very great, and, as we rely upon the annual dues to pay the running expenses of the Academy, the membership should be increased, the best means of doing this being to give such interest to the Academy proceedings as will create a desire on the part of intelligent people to join in its work.

The greatest need of the Academy at this time seems to be active workers. We have in the past been greatly blessed by having an efficient corps of laborers, whose work is shown in every department; but we need new material to add to and fill the ranks as the older members are compelled, from any cause, to cease their labors. To this end we should present every inducement and encouragement to scientific study, and offer every facility possible for that purpose, by having the museum and library in as good working condition as possible, and by our meetings and publications interest the people in science.

During the past year we have been called upon to mourn the loss of two members, death having taken from us Dr. R. J. Farquharson and Dr. George Englemann.

A resolution of thanks was received from the Agassiz Chapter for the free use of rooms and accommodations for their meetings.

THE STANDING COMMITTEES

were then announced, as follows:

Finance—W. H. Fluke, G. P. McClelland, Rev. A. M. Judy, H. C. Fulton.

Publication—Mrs. M. L. D. Putnam, Prof. W. H. Barris, Dr. C. C. Parry, James Thompson, Dr. C. H. Preston.

Museum—W. H. Pratt, William Riepe, Prof. D. S. Sheldon, Prof. W. H. Barris, Capt. W. P. Hall, E. P. Lynch, Miss Julia Sanders.

The following paper was presented by title, and referred to the Publication Committee: "Discovery of the Oldest Historical and Astronomical Inscriptions of North America," written in the year 2400 B. C., by G. Seyffarth, Ph. and Th. D.

On motion of Dr. Preston, the following resolutions were adopted without dissent, as stating more fully the sentiments of the Academy in regard to the attack of Mr. Henshaw:

WHEREAS, The Second Report of the United States Bureau of Ethnology contains an unjust and gratuitous attack upon the honor and good faith of this Academy and some of its members, calling into question the genuineness of certain articles in its museum; and

WHEREAS, Such attacks must tend to impair and destroy the usefulness of such collections, and to discourage earnest and faithful workers in their disinterested labors; therefore

Resolved, That justice and the interests of science imperatively demand a complete refutation of these charges, and vindication of the character of the parties attacked, and especially of our honored associate, Rev. J. Gass; and

Resolved, That the following paper, prepared by Mr. C. E. Putnam, President of the Academy, and, as we are fully satisfied, representing the whole matter in all truth and fairness, be adopted as our reply to the articles in question; and

Resolved, That copies of said paper be published immediately, under the direction of the Academy Publication Committee, in pamphlet form corresponding with the Academy "Proceedings," and that the same be distributed, as far as possible, to parties who receive the said Report of the Bureau of Ethnology, and to all known archæological associations and individual collectors and explorers, and to all publishers and writers on the subject, and that a record be kept of all to whom it is sent.

February 6, 1885.—SPECIAL MEETING.

President Putnam in the chair; thirteen members and twenty-five visitors present.

Professor T. H. Jappe gave an address on "Kant's Philosophy of Religion."

February 27, 1885.—REGULAR MEETING.

Vice-President C. E. Harrison in the chair; ten members present.

Mr. H. C. Fulton, chairman of the Committee on the "Carnival of Nations," reported net proceeds amounting to $450. On motion of Dr. C. H. Preston, a vote of thanks was tendered to all who contributed to make the entertainment a success and a memorable event.

Reports of officers presented.

The paper (illustrated), by Dr. J. W. Hoffman, of Washington, D. C., entitled "Aboriginal Art in California and Queen Charlotte's Island," was read and discussed.

March 4, 1885.—TRUSTEES' MEETING.

President C. E. Putnam in the chair. Nine members present; also four members of committees in attendance, by request of the President.

Voted, To purchase of Mrs. P. V. Newcomb a strip of four feet adjoining the Academy lot along its north line, at eighty dollars ($80) per front foot.

Voted, To provide increased space for books by erecting additional shelving on both the east and west walls in the library room.

Voted, That the salary of the Curator for the current year be five hundred dollars ($500).

Voted, That $112.50 borrowed from the Endowment Fund several years ago be returned to that fund.

Voted, To ratify the action of Library Committee in subscribing for the Scientific American and Supplement, Science and Popular Science Monthly.

March 27, 1885—Regular Meeting.

President C. E. Putnam in the chair; eleven members present.

Reports of officers presented.

Mr. James Thompson read a paper on "Evolution of Dress." The Agassiz Society being in session in an adjoining room, adjourned on invitation to hear the paper, and filled the room. An interesting discussion followed the reading of the paper.

April 20, 1885.—Trustees' Meeting.

President C. E. Putnam in the chair; ten members present.

Mr. Putnam reported the purchase of the four feet of land adjoining the Academy lot, and a note given for the amount, $320, for one year, at 8 per cent interest.

Voted, To invest $1,000 now in the savings bank in good real estate security at the best rates obtainable.

April 24, 1885.—Regular Meeting.

President C. E. Putnam in the chair; nine members and one visitor present.

Reports of officers read and filed.

A biographical sketch of Dr. R. J. Farquharson, by Dr. D. W. Middleton, was, in his absence, read by Dr. C. H. Preston, and referred to the Publication Committee.

May 29, 1885.—Regular Meeting.

President C. E. Putnam in the chair; ten members present.

Reports of officers read and filed.

Photographs of Painted Rocks of Rio Grande County, Colorado, sent to the Academy by Mr. Maguire, were inspected by members, and description of same read.

A letter was read from Capt. W. P. Hall, stating that on August 18th, 1876, he came upon a small pen on the banks of Rock River, in which an Indian was sitting, sunk in the earth about even with the head, not covered, and in a bad state of decay, the stem of his pipe still between his teeth. He was of the Musquakie or Fox tribe. On May 28th, 1885, he again visited the same locality, and, digging about one foot of earth and leaves away, found two hatchets, one pipe, and a spear head (the wood being too rotten to save), which he donated to the Academy in the name of his daughter, Miss Grace Hall. The bones he left undisturbed.

A letter was read, also, from Dr. C. C. Parry, giving an account of "A Visit to Blakemore Ethnological Museum, at Salisbury, England."

Mr. A. S. Tiffany then read a paper on "Subsidence and Erosion."

June 26, 1885.— Regular Meeting.

Vice-President C. E. Harrison in the chair; ten members present.

Marquis de Nadaillac, of Paris, was elected a corresponding member.

Dr. E. H. Hazen read a paper on "Sanitation as a Profession," which was followed by a discussion.

Voted, To grant request of Agassiz Chapter to use Academy Hall and specimens for an entertainment on July 4th.

August 28, 1885.— Regular Meeting.

President C. E. Putnam in the chair; eight members and five visitors present.

Letters were read in regard to the Henshaw attack on the Academy from the following persons: Dr. E. H. Davis, S. A. Miller, Rev. J. P. MacLean, Dr. W. DeHass, E. P. Vining, W. E. Barnes, Dr. D. G. Brinton, Prof. F. W. Putnam, Marquis de Nadaillac, Prof. Alex. Winchell, Dr. J. B. Holder, J. Henry Comstock, Max Uhler, Prof. J. Thorburn, C. Hirschfelder, Dr. S. D. Peet, and several others.

Voted, That the papers and correspondence referring to the Henshaw paper, and the reply thereto be referred to the Publication Committee with power to act.

October 30, 1885.—Regular Meeting.

President C. E. Putnam in the chair; sixteen members present, and members of Agassiz Chapter and visitors to the number of fifty-two.

Dr. W. DeHass, of Washington, D. C., being present, routine business was deferred to an adjourned meeting, and the audience listened with great interest to his address on "The Ancient Mounds of America."

Dr. C. C. Parry having returned from Europe, gave an account of his visit to the Blakemore Museum, making special mention of a very large collection of American Mound relics there displayed.

November 21, 1885.—Trustees' Meeting.

President C. E. Putnam in the chair; eight members present.

Finance Committee reported having loaned $1,000 of Endowment Fund to Daniel Preston for five years, at 8 per cent interest, payable semi-annually, secured by mortgage on a farm appraised at $3115.25.

Voted, To dispense with door-keeper, and make admission to Museum free after January 1, 1886.

Voted, That the Curator be authorized to make the exchange desired by Dr. DeHass, of specimens of pottery from our collection for other articles; also, to send Prof. F. W. Putnam, for the Peabody Museum, one specimen of the large pots received from the South.

Mr. Fulton, on the payment of $50, was made a life member.

Bills for matting and repairs, to the amount of $21.45, were allowed and ordered paid.

November 27, 1885.—Regular Meeting.

President C. E. Putnam in the chair; ten members present.

Professor R. Ellsworth Call, Moline, Illinois, was elected a regular member, and Mr. W. A. Chapman, Okolona, Arkansas, a corresponding member.

Mrs. Putnam reported that Professor J. P. MacLean, of Hamilton, Ohio, had given a lecture on November 25th, on the "Ancient Mounds of Ohio," for the benefit of the Academy, the net proceeds of which were $15.00.

Chairman of Publication Committee reported that Volume IV. of the Proceedings had been printed, except an appendix now in course of publication, and that more subscriptions to the volume are needed to meet the expense of its publication.

The President laid before the Academy a correspondence between himself and Dr. Cyrus Thomas, Superintendent of the archæological explorations of the Bureau of Ethnology, said correspondence having been opened by Dr. Thomas. He gave extracts from a letter purporting to come from a member of the Academy to a member of the Bureau, which were of a character highly derogatory to the honor of some members of the Academy.

On motion, the following resolution was unanimously adopted:

WHEREAS, The correspondence of Prof. Thomas with President Charles E. Putnam has been submitted to the Academy; therefore, be it

Resolved, That the Academy extend a cordial invitation to Prof. Thomas, previous to his proposed publication, to visit its Museum, inspect the relics under discussion in the correspondence, examine the mounds where they were discovered, interview the finders, and investigate all available evidence.

December 26, 1885.—ADJOURNED MEETING.

President C. E. Putnam in the chair; nineteen members present.

H. P. Royce elected to regular membership. Professor Erasmus Haworth, of Oskaloosa, Iowa, made corresponding member.

Notice was given of the death of Mr. Richard Smetham, a life member, who died November 27th, during a visit to England. Dr. C. C. Parry read a brief sketch of Mr. Smetham, which was ordered published in the city papers and placed upon the records of the Academy.

EARLY REMINISCENCES OF RICHARD SMETHAM.

BY C. C. PARRY.

A well-known form, that for forty years has been familiar to all on the streets of Davenport, has, for several months past, disappeared from public view; and now word comes across the broad Atlantic waves that Richard Smetham, so long a resident here, has taken that last journey "from whence no traveler returns."

Born in England, January 8th, 1819; emigrating to America in 1845; making Davenport his home from the spring of 1846 to the summer of 1885; returning for a first and last visit to his native land last August, and dying among relatives at Southport, England, November 25th, 1885. In these brief items are comprised the principal record of a life of nearly sixty-seven years, well known to every one present, but by few really appreciated or understood.

As one of the earliest personal acquaintances of the writer in Davenport since the autumn of 1846, and recognizing from the first, under a reserved exterior, unusual natural and acquired abilities, esteeming him highly for his worth's sake, and only regretting that my limited means

of information will not afford full scope for doing justice to his memory as a friend and an associate life-member of the Davenport Academy of Sciences, I cannot well decline this opportunity of placing on record a few personal recollections, which may be of interest to those here present, and not inappropriate to this time and place.

The natural reserve which, in later years, formed one of the marked traits of Mr. Smetham's social character, were less conspicuous at an early day in the history of this and other western towns, when everybody was expected to take an active part in all public and social relations, and peculiarities of disposition were merely looked upon as objects of inquisitive curiosity. But in Mr. Smetham's case, under this constitutional reserve lay a concealed depth of warm-hearted, generous sympathy, manifest only to his most intimate friends, tinged, it may be, with a slight vein of piquant misanthropy. My first introduction, in the character of family physician, afforded but a brief insight into the sacred relations of family life, which in this particular case were sedulously maintained, and guarded from outside intrusion for many years. The little, lowly cottage, with its picturesque site, crowning the hill overlooking the broad valley of the Mississippi, which he first selected for his western home, remained unchanged except in a thicker profusion of fragrant lilacs and blooming roses, while overtopped on every side by stately mansions of refinement and architectural elegance, located in part on his original purchase, and fairly represented his own unobtrusive character of only half-revealed attractions.

Only once that I can remember in the period of his active life (in 1848), Mr. Smetham undertook what in those days was an adventurous journey, on a raft, from the falls of the St. Croix to St. Louis, and, while speaking with enthusiasm of the natural beauties of this trip, he never seemed inclined to repeat its accompanying hardships.

Somewhere about this time (probably in the winter of 1848–9), the writer was associated with him in an organization called The Trans-Mississippi Club, the object of which was to keep up a friendly intercourse of members during life, by yearly meetings and personal records. This worthy object was, however, never carried out, and our first annual festival was also our last. According to my present recollection, but one member of this club, beside myself, is now living in Davenport.

As Mr. Smetham was known to possess a high order of literary ability, he was frequently urged — but always declined — to give any public exhibition of the same; only one little poetic gem, which I shall notice later on, thrown off from his ready pen, found place in print, in the pages of the *Weekly Gazette* in 1847.

As years passed on and other engagements called the writer to far distant scenes of labor, Mr. Smetham, instead of cultivating in public his higher abilities, assumed in turn the routine drudgery of a country editor, a post-office clerk, a deputy county treasurer, and finally a bank cashier. In all these unattractive positions the duties assigned him were always carried out with scrupulous exactness and unswerving fidelity. It was only as a side issue, and with a view to needed relaxation that he exercised his taste as an art connoisseur, and became an

active member and liberal patron of the Davenport Academy of Sciences. Beneath that earnest face as a frequent attendant at our regular meetings, lurked the hidden fire of a repressed, thoughtful zeal, which we would have been glad to see expressed in fitting words had we the magic power to evoke them; but it was not to be—like the hero of Gray's Elegy, which, in many other respects he resembled, he calmly chose

"Along the cool sequestered vale of life
To keep the noiseless tenor of his way."

With ample means at his command, he apparently never ventured beyond his first land speculation, and postponed until too late in life the inspiration he might have received from a visit to his native land. Only after years had diminished his physical vigor, and tinged his locks with silver—after his invalid wife had been laid at rest beneath the prairie sod, did he undertake alone this long-postponed journey, leaving an only daughter behind, anxiously expecting news of his speedy recovery—instead of which comes the hasty summons to his death-bed; alas! not soon enough to receive his parting blessing. And now our friend and associate finds a peaceful grave in the land of his birth and early youth.

Let me now, as his old-time friend, do the best thing for his memory by bringing from its obscure hiding-place and putting on permanent record in the proceedings of this Academy, of which he was so long an honored member, the poetic gem before alluded to, entitled "A Prairie Sunset," an ode which in its keen appreciation of natural scenery, its graphic imagery, tender vein of pathos, and polished poetic diction, would be worthy the pen of a Gray or a Bryant.

It is introduced by the following characteristic note in the *Weekly Gazette* of February 22, 1847:

DAVENPORT, IOWA, February 11, 1847.

MR. EDITOR:

Sir—The enclosed verses were written last fall, and are offered to you for publication in the hope that they may claim from local interest the attention which they may fail to awaken on the score of poetic merit. I admit your right, as the priest of your own oracle, to print or refuse them, and I have only to beg that should you deem them unworthy of your paper, your stove alone may be the repository of the secret of their existence.

Yours, etc., R. S.

A PRAIRIE SUNSET IN AUTUMN.

Emblem of the Eternal! gorgeous sun,
How vainly doth the laboring mind essay
To laud thee worthily; since time begun,
Supremely beauteous, thy transcendent ray
Has glittered in the poet's verse, yet none
Hath yet half told thy glory, King of Day!
Till human praise can match angelic song,
The Muses' highest flight will do thee wrong.

How grand thy course, and how august thy birth:
God said "Let there be light," and suddenly
Light followed the behest; the heavens, the earth,
The thronging universe, were full of thee;
Thy disc blazed luminous, and light went forth
With swift diffusion, over land and sea;
The morning stars sang rapturous at thy rise,
And dungeon darkness changed to Paradise.

This morn thy face through mists was faintly gleaming;
The hot meridian saw thee conquest-crowned.
'Tis eve. And now thine eye is softly beaming,
Throwing long shadows on the broidered ground,
And mellow floods of golden rays are streaming,
Bathing in joyous lustre all around;
Till by thy smile to this poor earth is given
A rich reflection of the hues of heaven.

The sky is crowded with magnificence
To grace and illustrate thy short adieu;
Deep orange is the horizon, from thence
Stretches a lengthened belt of saffron hue,
Bordered with streaks of violet intense,
Attenuating gently into blue;
While in the east a line of silver light
Proclaims the coming of the Queen of Night.

Far round the boundless prairie sinks and swells
With long, low rolls, like a subsiding sea
Which, by strong magic and most potent spells,
Congealed in all its waves, has ceased to be
A thing of ebbs and flows; these hills and dells,
Clothed with luxuriance, flourish steadfastly,
But at this hour the varying landscape seems
To borrow motion from thy shifting gleams.

The genial atmosphere is full of balm;
A Sabbath stillness reigns o'er hill and dale;
Save when the grouse with soft wings fans the calm,
Or with sharp whirrings springs the startled quail,
Or where yon small bird pipes his evening psalm;
The nearest house seems like a distant sail:
The bland air vibrates to no human tone,
With peace and solitude I am alone.

Yet not alone! the spirit hath a dower
Of dear remembrance, safe from time's attack,
A sacred treasury, and there is power
In the warm smile of Nature to call back,
Through the bright vistas of this sunset hour,
Those who have wandered with us o'er life's track,
Whose hearts are founts of purest sympathies,
And love right fondly such a scene as this.

They come in spirit from that distant shore,
The mother-land which late I called my home;
That sea-girt isle which I may see no more;
But 'tis a bliss to know, where'er I roam
That neither lapse of time, nor tempest's roar,
Nor constant washing of the salt sea foam,
Can sunder soul from soul, while they may still
Drink kindred draughts from Nature's gushing rill.

And now the broad red orb has sunk from sight;
The shadows deepen; in the glimmering skies
Lingers a faint and fast receding light;
A misty cloak o'er all the landscape lies;
The dew falls, shaken from the wings of night;
O'er the expiring day the fresh wind sighs;
And I will homeward turn, with thankful heart
That in Creation's joys I still may claim my part.

(Davenport, 1846). R. S.

On motion, the following resolution was adopted:

Resolved, That a committee of five be appointed to act in consultation with the President of the Academy, to investigate the matter of the conduct of Mr. A. S. Tiffany, in impeaching the genuineness of certain very important relics in our museum, and in putting in circulation grave charges against the honor and good faith of his associate members, without having first presented his charges before the Academy.

The following were appointed as such committee: Messrs. H. C. Fulton, D. S. Sheldon, C. H. Preston, James Thompson, C. C. Parry.

January 27, 1886.—ANNUAL MEETING.

President C. E. Putnam in the chair; thirty members present.

Reports of the various officers were presented.

Reports as condensed for publication, as follows:

TREASURER'S REPORT.

Receipts from all sources	$1,138 21
Disbursements	1,131 59
Balance in treasury	$ 6 62
Floating Debt	$ 108 70
Permanent Endowment Fund	$1,156 95

W. H. FLUKE, *Treasurer.*

RECORDING SECRETARY'S REPORT.

Regular Academy Meetings	12
Number of Regular Members	170
Number of Life Members	80
Number of Corresponding Members	303
Visitors during the year (1885)	2,273

The Rooms of the Academy have been occupied during the year by the Scott County Horticultural Society, the Scott County Medical and Pharmaceutical Societies, and the Agassiz Club.

LUCY M. PRATT, *Recording Secretary.*

LIBRARIAN'S REPORT.

Additions to the Library during 1885.....3,196

DR JENNIE MCCOWEN, *Librarian.*

REPORT OF PUBLICATION COMMITTEE.

Receipts.....$525 25

Expenditures.....590 60

Volume IV. nearly completed. Funds necessary for completion of the volume, $300.

MRS. M. L. D. PUTNAM, *Chairman.*

CURATOR'S REPORT.

The additions to the Museum for 1885 included a large number of archæological relics presented by Captain Hall, a small prehistoric vessel made of steatite from California; an earthen pipe, and another of red pipestone, both apparently Indian pipes, a stone relic inscribed with some very curious characters, all found in this vicinity; several historical relics, a few mineralogical specimens; mastodon bones and teeth; a Japanese book of thin sections of the Japanese woods—one hundred species and three sections of each; three live rattlesnakes; a collection of southern shells, including some new species; and other less important articles, too numerous to mention. The Academy needs a cabinet, illustrating our local geology as fully as possible, and also a systematic collection in geology and mineralogy, both properly classified for reference and study, as they would render valuable aid to members and young societies, and to classes who might visit them from the public schools.

W. H. PRATT, *Curator.*

PRESIDENT'S ANNUAL ADDRESS.

BY C. E. PUTNAM.

LADIES AND GENTLEMEN:

In the performance of the duty which devolves upon the President, it has been the almost uniform practice with those who have preceded me to embrace in the annual address a synopsis of the reports of the several officers of the Academy; but, as the condition and progress of the various departments are set forth in these reports, I shall upon this occasion depart from the usual custom, and omit any reference to these details.

When, at the last annual meeting of the Academy, I yielded to the urgent solicitation of its life members, and accepted the position I now hold, it was with many misgivings whether the absorbing cares of a professional life would afford me sufficient leisure to properly perform its duties. The delightful studies, the intricate researches, the profound and thoughtful discussions which make up the life of a scientific association, are so exacting in their requirements as to almost exclude the ordinary men of business, and limit its active

membership to the select students of science. But, learning that this fair structure, which embodies so many hopes, fears, struggles, which has been sanctified by sacrifice and ennobled by high ideals, was being assailed from without, and that a crisis had arrived in the history of the Academy when its friends and patrons must rally to its support, I could not refrain from taking my place in the ranks, and using my best endeavors to protect it from impending ruin.

At the close of the preceding year there had appeared in the Second Annual Report of the Bureau of Ethnology, connected with the Smithsonian institution, a virulent attack upon the authenticity of the inscribed tablets and elephant pipes in the museum of our Academy, and this was accompanied by a most unjustifiable assault upon the Rev. Mr. Gass, the principal discoverer. These charges against our Academy were made by Henry W. Henshaw, an employe in that department, and had the approval, and were published with the endorsement of, Major Powell, the Director of the Bureau. As the high position attained by the Academy in the world of science has been largely due to these important discoveries, it will be perceived that to permit this charge to go undefended would be not only an injustice to the discoverers, but destructive of its influence and usefulness. The gentleman making these accusations was not an archæologist, never inspected the relics in question, was never on the ground where they were found, was unacquainted with the discoverers, as also with the members of the Academy, never made an inquiry of either, and hence it should surprise no one that his publication was made up of blunders and falsehoods in about equal proportions. Still, as it appeared in a government publication, and thus was supported by official sanction, it was calculated, if uncontradicted, to do great injury. Early in the past year, therefore, a paper was prepared setting forth the facts in the case, and pointing out the errors in the published statement of Mr. Henshaw, and this vindication of the authenticity of our relics was printed in pamphlet form, and widely distributed. It was generally received with favor and approbation, as is evidenced by an extensive correspondence with eminent archæologists in this country and Europe. There should be nothing discouraging in this controversy to the members of the Academy. We all know Rev. Mr. Gass to be a worthy and true man, we all have entire faith in the genuineness of our relics, and, in the end, truth and justice will prevail. Indeed, this attack itself attests the great scientific value of these interesting relics. It discloses, too, the pregnant fact that, in the honorable strife for precedence in archæological research, we have outstripped our competitors, and hence this abortive attempt to detract from the value of our discoveries. It also makes it clear that at last the Academy has reached the age of manhood. In our infant days we were encouraged some, petted perhaps a little, occasionally, it may be, passed by with indifference; but now that our little planet has crossed the orbits of these official luminaries, we are the recipients of sturdy blows, which indicate that we are at last recognized as among the stalwarts in the scientific world. I therefore congratulate you, ladies and gentlemen, that we have at last attained to

the age of persecution, and can now claim for our Academy the crown of martyrdom.

The Davenport Academy has sprung into being, as it were, in a night, and seems almost like some fantastic fairy structure. Yet here it stands, real, substantial, a goodly edifice, with possessions gathered from the earth and the seas — a vast treasure-house of scientific riches. The publications of our Academy are in all the public libraries of the world, and in exchange we have regularly placed on our tables the publications of other scientific societies, in every tongue and from all civilized lands. It is undoubtedly true that our little Academy is now recognized as among the few successful organizations in our country. Yet it has had no capital, no endowment, no income. It relied only on faith, hope, persistence, but these have never failed it. It had only to express a need, and it was provided for; only to proffer a request, and a whole community, as it were, rose up to grant it. What means this wonderful success? Simply this: Our Academy belongs to the city; it represents the best thought, the highest aspirations of its citizens. Their wealth is its capital, their generosity its endowment, their thoughtful care its income. Why, look you, ladies and gentlemen, only a year or two since, the attention of the friends and patrons of the Academy was called to a burdensome debt hanging over it, and immediately our citizens crowded to the rescue. A few prominent and influential men directed the movement, spoke only a few earnest, well-directed words, and the debt disappeared like the mists of the morning. So, too, early in the past year, funds were needed to meet some small current obligations, and immediately there was conceived in the teeming brains of some of our members a "Carnival of All Nations." The entire community entered with zeal and energy into the realization of this happy thought, and the result was a magnificent representation, which makes almost an epoch in the history of our city. It brought amusement and instruction to its participants, and a considerable increase of resources to the Academy. Thus it is our Society is buoyed up, and carried onward by the necromancy of success.

In this connection it may be well to add a few words of explanation concerning the Endowment Fund. Of the amount raised at the citizens' meeting a few years since, the surplus of about eight hundred dollars remaining after the payment of the debts of the Academy, increased during the past year to the sum of one thousand dollars through the legacy of the late Robert McIntosh, has been securely invested in a farm mortgage, bearing eight *per centum* interest, and this is now the nucleus of our Endowment Fund. Belonging to this fund there still remains a small balance which will be invested in like manner as soon as the amount is sufficiently large to make it practicable. It is with societies as with individuals, when they live within their incomes and begin to save, their success is assured. During the past year an opportunity was afforded the Academy to purchase four feet of ground adjoining its building on the north, and, as it was essential for both light and ventilation, the proposition was accepted. The note of the Academy for three hundred twenty dollars, the price of the same, is

now outstanding, and early provision should be made for its payment.

The Constitution of our Academy provides for a permanent Publication Fund, the income of which should only be used to carry on the publication. Quite recently, Mr. Charles Viele, of Evansville, Indiana, contributed the sum of fifty dollars as the commencement of this fund, which entitles the donor to receive all the publications of the Academy issued thereafter for life. Building on this corner-stone so auspiciously laid, we shall confidently expect in the near future to have this fund well established by other generous contributions. The value of the regular publication of our proceedings cannot be overestimated. It incites to original research, and through exchanges keeps us acquainted with the most recent investigations and discoveries throughout the scientific world. But for the information thus acquired we might be groping at the solution of problems already solved by other investigators. Undoubtedly the high standing of our Academy at this time is in large part due to its enterprise in thus publishing to the world its great discoveries. During the year, through the indefatigable exertions of the Publication Committee, the printing of Volume IV. of our Proceedings has been successfully accomplished, and the volume will soon be ready for distribution. It is a gratification to be able to state that this work has been carried on without imposing financial burdens upon the Academy, and that in point of scientific interest it will compare favorably with preceding volumes.

In the early autumn it was decided, with the beginning of the new year, to throw open the Museum and Library of the Academy to the public, free of charge for admission. Accordingly, on January 1st, the door-keeper was withdrawn, and now any citizen of Davenport, or any stranger visiting the city, is entitled to freely inspect its museum and consult its library. As this institution has been built up by the voluntary contributions of citizens, it seemed only right and proper that all should have free access to its building, and an equal share in its privileges. Visitors hereafter will only be required to conform to certain rules and regulations essential to the preservation of its valuable collections.

It was also wisely decided, some time since, to open the Academy building during certain hours on the Sabbath day. It is well known that there are large numbers among our business men, as well as among the artisan and laboring classes, whose only leisure is on this day; and hence, but for this beneficent arrangement, they would be debarred from its privileges. It is considered that this new policy will subserve a wise and good purpose. The great book of Nature, which is here opened for study, cannot be otherwise than purifying and ennobling in the formation of character, and the educating influences thus exerted are as far-reaching as they are beneficent. I know of no instrumentality so effective to counteract the dissipation and frivolity which too often and with too many rule this day. Those mistake who think that our scientific workers are alone found among the wealthy or the highly educated. Many an artisan, as he passes along to his daily task, is pondering some of the deep problems of science, and not infrequently

the hard hand of toil is accompanied with the thoughtful brow of the student. The masters of the future in science, as in politics, will come from the ranks of industry, and therefore it is a wise provision which affords to this class such excellent opportunities for improvement.

The fact must not be overlooked that institutions like this Academy take high rank in the scheme of public education. In them the student is brought face to face with Nature — the great storehouse of all knowledge. Here are learned lessons of close observation and careful research, and out of the habits of mind thus formed have come the great discoveries and inventions which distinguish our modern civilization. It seems almost impossible to exaggerate the beneficent influences which result from the study of science. Instead of passing the best years of life mastering the "dead languages," which, when acquired, can be of little practical value, those engaged in scientific research learn the great truths of creation, and master the utilities of life. The discoveries of steam and electricity, for example, and the inventions by which these mighty elements have been subjected to human use, are among the direct results of the studies encouraged by such institutions, and it is these things which make up the superiority of modern over ancient civilization.

It is undoubtedly true that the ranks of our members engaged in original research have been somewhat thinned by death and removal, and this fact has been the occasion of some solicitude concerning the future of our Academy. We, however, need entertain no fear, for the workers are near at hand. There has recently been noticed among the youth of the land a great scientific uprising, which is destined to rank as one of the epochs of history. In 1880 an Agassiz Association was formed through the instrumentality of Harlan H. Ballard, of Lenox, Mass., having for its object the study of natural history among young persons. There are now over nine hundred separate chapters in this and other countries, with over 10,000 members. The institution has an excellent organization. Each chapter must have not less than four members, and may elect its own officers, adopt its own rules and pursue whatever course of study is deemed desirable. The first great convention of the Agassiz Association was held at Philadelphia, in 1884, and it is in contemplation to hold the next national gathering in Davenport during the coming summer. There are two Davenport chapters of this association, one containing thirty-two members, consisting mainly of high school scholars, and the other about forty members, derived from the grammar schools. Both chapters hold weekly meetings in the Academy building. We thus have our scientific successors close at hand, and therefore need have no fear but that our work will be taken up and carried onward to a still more splendid success.

It should be noted in this review that during the past year we have been favored with visits from Dr. Willes De Hass, of Washington, D. C., and Rev. J. P. MacLean, of Hamilton, Ohio. Both these distinguished archæologists, while in Davenport, delivered lectures gratuitously, for the benefit of the Academy. Dr. De Hass, it will be remembered, was the gentleman who took the famous Grave Creek tablet to Washington.

and placed before the world the facts of its discovery, and Rev. Mr. MacLean, in his "Mound Builders," has, perhaps, advanced the strongest arguments yet presented tending to establish the authenticity of that interesting relic. There are thus no more competent archæologists in the country, and both these gentlemen, after a careful examination of our Elephant Pipes, and inquiry into the history of their discovery, expressed entire confidence in their authenticity.

During the past year we have been called to mourn the loss of Mr. Richard Smetham, one of our life members. While this kindly and genial gentleman did not personally engage in scientific research, he had an intelligent appreciation of its value, was a frequent visitor to our rooms, and took a lively interest in the welfare of the Academy. A gentleman of delicate sensibilities, generous culture, and fine abilities, his loss leaves a vacancy in the ranks of our life members not easily filled. Our associate, Dr. C. C. Parry, has already made the death of Mr. Smetham the subject of a most appropriate obituary notice, which appears in our published proceedings.

Before closing this review, it is fitting we should recall the fact that it is a principal object of an association like our own to advance the frontiers of human knowledge, and it will be well, therefore, for us to pause, take a backward glance over our career, and ascertain what contributions we have made to the great storehouse of facts. Man is placed here on earth surrounded by mystery, and it is only here and there some adventurous explorer penetrates this vast unknown, and brings to light some new fact of creation. Thus, the duration of man's existence on earth has long been the subject of extensive research and profound speculation. In the special field of archæology this Academy has accomplished important results. Our pottery, our cloth-covered copper axes, our inscribed tablets, our elephant pipes, are absolutely unique, and unequaled in any other collection in the world. They carry back the age of man into the far distant past, when the gigantic mammoth frequented our prairies, while yet the glaciers were at work preparing a home for civilization. And when the history of these wonderful relics shall be written, it will not fail to record the adventurous voyages of the "Old Man in the Skiff," Capt. Wilfred P. Hall, which have enriched our museum with all this rare old pottery; it will take note, too, of the disinterested and indefatigable labors of Rev. J. Gass, in his ceaseless delving in mound and earthwork until he brought forth, and freely placed in the museum of the Academy, relics from the far past so rare they open a new page in human history; nor will the historian fail to take count of the intelligent observation, the exact knowledge, and the tireless labors of our Curator, Prof. W. H. Pratt, in bringing order and symmetry out of all this mass of material, and thus making possible its scientific study. So, too, in another line of research, our associate, Prof. W. H. Barris, has penetrated into the bowels of the earth, and read so truthfully the story of the rocks that they must bear his name to distant generations. And who does not know that the name of Dr. C. C. Parry has been stamped upon the mountain peak, and traced in lines of beauty on many a mountain

flower. And may I not add, that whomsoever in future years shall seek to study the *Solpugidæ*, must needs come back to the early labors, the exact researches of that young entomologist who gave this study his parting breath, his last thought on earth. True it is, the man who adds a new fact to the sum of human knowledge is entitled to a place among the immortals; and it may be our citizens have builded better than they knew, and that this foster-child of their bounty will not only carry the name and fame of their fair city into other lands, but will perpetuate it to distant ages.

It only remains for me to call your attention to the fact that at no distant day it will be found necessary to complete the present building. It is already needed. The museum is now crowded to overflowing. For want of shelf-room, it is found impossible to properly arrange and classify all the specimens in our collection. The books and pamphlets, too, which have come to the Academy without cost, now crowd its shelves to repletion. The generous citizens of Davenport must finish their good work, and give us more room in the near future. To accomplish this only requires concert of action. Where many coöperate, the individual burden is light. The anticipation of this completed building has been in the thoughts of earnest workers of the Academy these many years. In this world of ours the ideal precedes the real, and slowly but surely faith works out its problems. The completed building will, therefore, soon be erected, and when that happy hour arrives and our citizens throng its corridors to witness the spectacles it presents, methinks, to the eye of faith, the curtains that separate us from infinity should be put aside, and we be permitted to behold, standing on that other shore, an old man and a youth, with the once closed ear now attuned to the music of the spheres, and the wonted wan cheek now all aglow with the bloom of the celestial hills; and to the ear of faith there should come sounding across the abyss their glad acclaim: "It is finished! It is finished!"

ELECTION OF OFFICERS.

President — C. E. Putnam.

First Vice-President — C. E. Harrison.

Second Vice-President — J. B. Phelps.

Treasurer — Major G. P. McClelland.

Recording Secretary — Dr. Jennie McCowen.

Corresponding Secretary — W. H. Pratt.

Librarian — H. A. Pilsbry.

Curator — W. H. Pratt.

Trustees — 1st, Dr. Preston; 2d, James Thompson; 3d, E. P. Lynch; 4th, H. C. Fulton.

January 29, 1886.—REGULAR MEETING.

President C. E. Putnam in the chair; fifteen members present.

STANDING COMMITTEES

were announced, as follows:

Finance.—G. P. McClelland, E. P. Lynch, J. B. Phelps.

Publication.—Mrs. M. L. D. Putnam, Dr. C. C. Parry, Prof. W. H. Barris, Dr. C. H. Preston. James Thompson.

Library.—H. A. Pilsbry, C. E. Harrison, H. C. Fulton.

Museum.—W. H. Pratt, H. A. Pilsbry, Prof. D. S. Sheldon, Prof. W. H. Barris, William Riepe.

Mr. Harrison called attention to the locality of the Signal Service thermometers as objectionable, occupying the center of a flat tin roof on a building heated by steam, with the surrounding chimney-tops sending up volumes of heated air. A discussion on the subject ensued.

January 29, 1886.—TRUSTEES' MEETING.

President C E. Putnam in the chair; eight members present.

Voted, To keep the museum open from 10 to 12 A. M., from 2 to 4 P. M., and on Sundays, from 2 to 4 P. M.

Voted, To continue salary of Curator at $500 per annum.

The following resolution was unanimously adopted:

Resolved, That in view of the crowded state of the museum, it is not considered advisable for the Academy to longer continue the custodian of private collections, and that the Secretary is hereby instructed to notify the owners of such collections that they are requested either to donate them to the Academy or to remove them from the building.

Voted, To grant the request of the Agassiz Chapters for the use of rooms in the basement.

Voted, To grant the use of the Academy to Mrs. Putnam, for the usual entertainment for children, on the 22d of February.

February 12, 1886.—SPECIAL MEETING.

Vice-President C. E. Harrison in the chair; six members present.

Committee on Programme reported as follows:

That at each meeting, a topic of discussion be announced in advance for the next meeting.

That a paper on that subject be secured, if possible; if not, that selections be read from the current literature accessible, followed by discussion or conversation germane to the subject.

That we confine ourselves chiefly to subjects in Natural Science, and that we suggest as suitable topics the following: "The Coal Measures

of Iowa, including the Building Stone of Iowa, including mention of Gypsum, Sand, Clay, and the Ochre from which Mineral Paint is made; Mathematics of Plants; Migration of Plants; Protective Mimicry of Animals; Protective Colors of Animals; Origin of Our Domestic Animals; Migration of Birds; Aerial Navigation; Explosives; Glycerine; Gutta Percha; Phosphorescence; Petroleum, its Manufacture and Uses; Electricity as a Motive Power; Meteoric Stones; Pottery."

Report adopted, and voted that this list, to which any subject proposed and approved at any meeting may be added, be kept by the Secretary, accessible to members.

A discussion then ensued on "Railroad Telegraphy." The subject of "Electric Motors for Street Cars" was also discussed.

February 26, 1886.—REGULAR MEETING.

President C. E. Putnam in the chair; twenty-two members present.

Curator reported the receipt of three boxes of pottery from ancient mounds.

Mrs. Putnam reported the proceeds of the entertainment on the 22d of February, $42.00.

Dr. Barris read a review of a pamphlet on the "Geology of Scott County, Iowa, and Rock Island County, Illinois," by A. S. Tiffany, which was referred to the Publication Committee.

Prof. R. E. Call read by title, and gave a synopsis of a paper on "New Fresh Water Mollusks."

H. A. Pilsbry and R. E. Call offered a paper on "Pyrgulopsis," a new genus of mollusk, with descriptions of two new species. Both papers were referred to the Publication Committee.

Prof. Call, as a new member, greeted the Academy, and congratulated the members on the value of its work and the worth of the appreciation it is receiving from all parts of the world.

March 18, 1886.—TRUSTEES' MEETING.

President C. E. Putnam in the chair; eleven members present.

On motion, the Finance Committee was authorized to make a temporary loan of $100, to pay the balance due for completion and distribution of Volume IV. of the Proceedings.

On motion, the Publication Committee was authorized to proceed with the publication of Volume V.

Mr. Putnam read a communication signed by himself and Mrs. Putnam, in regard to the entomological collection of their son, the late

J. Duncan Putnam, which had been on deposit in the Academy since 1877, and asked the appointment of a committee, with whom to confer in arranging the terms to be attached to the proposed donation.

The following committee was appointed: Dr. C. C. Parry, Prof. Herbert Osborn, W. H. Pratt.

March 26, 1886.—Regular Meeting.

Vice-President J. B. Phelps presiding; twenty-eight members present.

Publication Committee presented bound copy of Volume IV. of the Proceedings, with brief statement of contents. Reported an extra issue of five hundred copies, necessary to supply the demand, growing each year, for our exchange list; also, an increase in the number of pages over any previous volume. Arrangements are already perfected for commencing Volume V., four papers of scientific value now in the hands of the Committee.

Mrs. M. L. Marks was elected a regular member; D. S. Harris, of Cuba, Illinois, elected to corresponding membership.

The special committee to investigate the conduct of Mr. A. S. Tiffany, under resolution of December 26, 1885, would respectfully report that it has carefully investigated the matter set forth in the foregoing resolution, and finds:

That Mr. A. S. Tiffany has impeached the genuineness of the so-called "limestone tablet" and "elephant pipes," by declaring by parole to a number of persons, and by declaring in a letter written by him to Prof. P. W. Norris, under date of October 27, 1882, which letter was given by said Prof. Norris to Prof. Cyrus Thomas, that said relics were frauds; all of which was done by Mr. Tiffany without having ever presented to the Academy any charges against the genuineness of said relics.

That in said letter, and also by parole, Mr. Tiffany has charged our associate, Mr. C. E. Harrison, with being a party to the alleged fraud, in having manufactured said "limestone tablet," and has made said charges without having ever presented the same to the Academy for investigation.

That Mr. A. S. Tiffany was before your committee, in person and by attorney. That he admitted having written said letter to Prof. Norris, but denied that he had made the charge orally, although it was in evidence that he had so done to several persons, and to at least one member of your committee. He also stated to your committee that he believed Mr. C. E. Harrison to be guilty of the fraud, as charged by him, and that he could prove his belief to be true; but refused to present any proof, or attempt the same, or to inform your committee why he held such belief, and gave as his reason for the refusal that he understood Mr. Harrison had threatened to bring a civil action against him

for damages arising out of the charges made, and that he considered the evidences of the alleged fraud matters to be used in defense against such an action, and that to put Mr. Harrison in possession of the same would give him an unfair advantage in the event of the threatened litigation. Mr. Tiffany further admitted that he had never presented to the Academy any charges against the genuineness of said relics, the genuineness of their finding, or against the honesty and good faith of Mr. Harrison in regard to the same.

Your committee has not deemed it within its province — under the foregoing resolution — to inquire into the genuineness of said relics, except as far as it might be necessary, in the event of evidence of fraud being offered. But no evidence has been offered that might, in any way, lead to the Academy changing its present position in regard to these relics; or to sustain any charges made by Mr. Tiffany. Neither is there any reason, known to your committee, for doubting the entire correctness of the statements made at the time of finding, or since, by the gentlemen concerned in the discovery of the relics.

In conclusion, your committee recommends that Mr. Tiffany — who, by his own acknowledgment, has been guilty of acts, as above mentioned, which are clearly unjust, and especially to be condemned in a member of a scientific association — be subjected to the penalty of expulsion from the regular membership of the Academy.

Dated March 26, 1886. Signed, H. C. Fulton.
C. H. Preston.
James Thompson.
C. C. Parry.
D. S. Sheldon.

On motion, the report was accepted and placed on file, and committee discharged.

The following resolution was then offered and passed — yeas, 25; nays, 2:

Whereas, The special committee appointed by the Academy on December 26, last, to investigate the matter of the conduct of Mr. A. S. Tiffany, in making and putting in circulation grave charges against the honor and good faith of his associate members, having reported that, after a careful investigation, it finds Mr. Tiffany, by his own acknowledgments, guilty of the charges made by the resolution, and that he still claims his charges to be true, but refuses to attempt to present any proof of the same; and

Whereas, The committee recommends that Mr. Tiffany be subjected to the penalty of expulsion from the regular membership of the Academy; and

Whereas, We believe the action recommended by the committee to be just, under the circumstances; that vindication against unproven charges is due to the gentlemen instrumental in the discovery of the relics charged to be frauds; that the Academy owes to itself the duty of protection against internal dissension, to the end that its energies may be directed to the purposes of its organization, and not to be wasted on controversies instituted without apparent

foundation, and encouraged by other than honest scientific motives; and further, believing that it would be unjust to require those whose honor and good faith are brought in question by the charges of Mr. Tiffany, to work in the Academy and attend its meetings with him; therefore

Be it Resolved, That Mr. A. S. Tiffany be, and hereby is, expelled from the regular membership of the Academy.

In view of statements made by Dr. C. T. Lindley, in his speech in defense of Mr. Tiffany, the following motion was offered:

Moved, That a committee, consisting of Messrs. G. P. McClelland, Rev. Dr. Barris, Prof. D. S. Sheldon, and J. B. Phelps, be appointed, to investigate the matter of certain defamatory charges against members of the Academy, made by Dr. C. T. Lindley.

Dr. Lindley desired to have G. W. French on the committee, and his name was accepted by the mover and added thereto.

The motion was unanimously adopted.

April 29, 1886.—TRUSTEES' MEETING.

President C. E. Putnam in the chair; nine members present.

Voted, That the Finance Committee be authorized to borrow a sum not to exceed two hundred and fifty dollars ($250), to pay indebtedness of the Academy not otherwise provided for.

Voted, To grant request of Agassiz Chapter to hold their Agassiz birthday anniversary meeting in the Academy.

April 30, 1886.—REGULAR MEETING.

President C. E. Putnam in the chair; thirty-two members present.

Mrs. M. L. Marks placed on the list of life members; F. M. Witter, of Muscatine, Iowa, elected a corresponding member.

The special committee, to whom was referred the investigation of the charges made by Dr. Lindley against members of the Academy, reported as follows:

Dr. Lindley charges, (1) That curved base pipes have been made in the Academy; (2) That people about town know it; (3) That Mr. Pratt knows all about it; (4) He (Lindley) not only knew that they were made, but had seen them made; (5) Mr. Tiffany had good reasons for his conduct, he knew the tablets were frauds, and that other frauds were committed; (6) He is not alone in this belief; it is shared by some of the most respected members of the Academy; (7) Mr. Harrison has made fraudulent tablets, and passed them off as genuine; (8) Mr. Pratt is dishonest in that if he should pack his (Lindley's) collection, he would drop out and leave behind the most valuable specimens; (9) The Committee on Tiffany's conduct did not want to reach the facts in the case, and were neither just nor fair in their action; (10) There are "goings on" at the Academy which he is going to throw light

upon. He is going to see that every scientist in Europe hears of these things, and every time they are smoothed over he is going to "boom it up again."

Your committee beg to report that, after a full examination, they find the charges made by Dr. Lindley not sustained. Lindley denied having uttered No. 7.

Signed, G. P. McClelland.
W. H. Barris.
J. B. Phelps.
G. Watson French.

Prof. Sheldon was unable to serve, owing to illness.

On motion, the report was received and the committee discharged.

May 28, 1886.—Regular Meeting.

President C. E. Putnam in the chair; thirty-seven members present.

On motion, the report of the investigation committee in the case of Dr. Lindley, was adopted.

Prof. D. S. Sheldon offered the following resolution:

Whereas, Dr. Clarence T. Lindley has repeatedly assailed the integrity of this Association and certain of its members, and has finally formulated and presented before the Academy certain defamatory charges, which, on a judicial investigation by a commitee consisting of G. P. McClelland, Rev. W. H. Barris, G. Watson French, and J. B. Phelps, were proved to be wholly unfounded; and

Whereas, The said Lindley has openly proclaimed his hostility to the Academy, and threatened to persist in his efforts to disturb its harmony and peace, and had thus violated his plain obligations as a member; and

Whereas, The longer retention of said Lindley as an associate would tend to impair the usefulness, and subvert the objects of this Association and injure its standing in this community, and discredit it among similar societies elsewhere; therefore

Be it Resolved, That Dr. Clarence T. Lindley be forthwith expelled from membership in the Davenport Academy of Natural Sciences, and that the Secretary be instructed to strike his name from the roll.

Dr. Lindley being present, and declining to withdraw during the discussion, on motion of Dr. Parry he was permitted to remain, if he desired to do so, and the yeas and nays on the motion to expel were called for in his presence, with the following result: Yeas, 36; nays, none.

Mr. H. G. Sharfenburg and John J. Dahms were elected to regular membership, and the following corresponding members were elected: Dr. S. F. Landry, Galveston, Indiana, Mr. Frank Leveritt, Denmark, Iowa, Pietro Bernabo Silorato, Rome, Italy.

A paper contributed by Mr. C. S. Watkins, on "Volcanoes in the Sandwich Islands," was read by Mr. Pratt, and referred to the Publication Committee.

May 28, 1886.—TRUSTEES' MEETING.

President C. E. Putnam in the chair; eleven members present.

Mrs. M. A. Sanders, in consideration of valuable donations, was made a life member, and the usual fee was remitted.

The President, the Secretary, and Dr. Preston were elected a committee to revise the by-laws.

June 5, 1886.—SPECIAL MEETING.

A special meeting of the Academy was called, on account of the death of Professor Sheldon.

Vice-President C. E. Harrison in the chair; eleven members present.

After remarks, Messrs. W. H. Pratt, W. H. Barris, and C. C. Parry were elected a committee to draft appropriate resolutions.

The trustees and members of the Academy were requested to meet at the Academy building, to attend in a body such services as may be held on the day of the funeral.

Adjourned until June 11, to hear the report of the Committee.

June 11, 1886.—MEMORIAL MEETING

in honor of Prof. David S. Sheldon.

President C. E. Putnam in the chair; thirteen members present.

The following resolutions were unanimously adopted:

WHEREAS, Our dearly loved associate and friend, Prof. David S. Sheldon, at a ripe old age, but in the midst of an active usefulness, has finished his work here, and entered upon the rest pertaining to the higher life,

Resolved, That in his departure, the Academy of Natural Sciences has lost a most efficient co-worker in the cause of science, and for the interests of the Institution, of which he was one of the founders, the first president, and always a zealous and active member.

Resolved, That we who remain will always bear in mind his accustomed kind and cordial greeting, and his cheerful aid and encouragement in all our plans. Naturalists and lovers of true science have long recognized in him the devoted student and the experienced teacher. Admirers of a true and noble life will mourn the removal of one of the brightest examples of such a life. Of him it may be most truly said: "The world is the better that he has lived in it."

Resolved, That in his death the cause of education loses one of the ablest and wisest workers; a teacher of teachers, whose pupils now scattered through this and foreign lands, ever turn to his memory with love and reverence.

Resolved, That we hereby express our deep sympathy with the relatives and connections, in the loss of such a loved member of the family circle.

Resolved, That these resolutions be entered upon the records of the Academy, and that copies be furnished for publication and for the daily papers.

Mrs. Putnam, on behalf of the Publication Committee, bore testimony to the great loss they had sustained in the death of one who had, from the first, given the enterprise his warmest support.

Remarks were also made by Dr. Parry, H. C. Fulton, Hon. George H. French, Mr. Pratt, and W. H. Holmes.

The biographical sketch of Prof. D. S. Sheldon, presented by Dr. C. C. Parry (since included in Vol. V., pp. 179–84) was referred to the Publication Committee.

June 25, 1886.— REGULAR MEETING.

President C. E. Putnam in the chair; six members present.

Curator reported a number of donations to the museum, among which were a cast of the "Waverly Tablet," from Prof. J. P. MacLean, of Hamilton, Ohio, and a collection of fossils from Prof. W. H. Barris, including the type specimens of crinoids figured in his papers published in the Academy proceedings.

Mr. Harrison desired to present his collection of several hundred natural history, geological and archæolgical specimens unconditionally to the Academy. This offer was accepted with a special vote of thanks.

In pursuance of action taken by the Academy and communication presented by Mr. and Mrs. Putnam, at a former meeting, regarding the presentation of the entomological collection, cabinets and library of the late J. Duncan Putnam, Dr. C. C. Parry, chairman of committee then appointed, presented the report of said committee, specifying certain conditions under which it would be proper that such presentation should be made and accepted by the Academy, viz.:

CONDITIONS

under which the J. D. Putnam Entomological collection is to be donated to the Davenport Academy of Natural Sciences.

1. The Academy to assume proper care of the collection, by having it examined at least once a year by a competent entomologist.

2. The accompanying cases and drawers not to be used for additional collections to the exclusion of original specimens, except to introduce more complete material, or more fully illustrate original species; badly injured or mutilated original specimens to be preserved in best possible shape, unless duplicated by two or more perfect specimens. Type-specimens of original description to be very carefully preserved, and conspicuously so marked.

3. All labels of locality, date, name, etc., to remain on the pins as originally placed, and any additional labeling or change of name to be placed on separate slips below the original.

4. No specimens or books to be taken from the building without the written consent of the Academy Trustees or the donors.

5. Accompanying entomological books to be plainly marked as the Putnam donation, and all unbound pamphlets not to be placed on the shelves for general use until bound by the Academy.

6. Failure to comply with said conditions to annul the donation; or, on the dissolution of the Academy or diversion to other than scientific objects, the donation to revert to the donors or legal heirs.

7. Academy to ratify these conditions by formal resolution, an official copy of which to be furnished to the donors.

Signed, C. C. PARRY.
HERBERT OSBORN (by letter).
W. H. PRATT.

The committee then presented the following resolutions of acceptance of the generous proposition:

Resolved, *First*, That the Davenport Academy of Sciences hereby formally accepts, under the conditions recommended by the report of a special committee herewith received and endorsed by the donors, viz.: The entomological collection, with accompanying cases and books, of the late J. Duncan Putnam, heretofore deposited in the rooms of the Academy.

Second, That in thus gratefully accepting this munificent gift, the Academy also desires to place on record its appreciation of the noble character of unselfish devotion to scientific objects which was so worthily displayed in the life and labors of our late associate, the gifted founder of the collection.

Third, We also desire, on this occasion, to express our high regard for that exhibition of parental encouragement and liberality which has proved an essential factor in bringing out such valuable results which, by this gift, are incorporated for all time in this institution, of which the virtual donor, J. Duncan Putnam, was an efficient co-worker and liberal patron, and an illustrious example worthy of our earnest imitation.

Fourth, That a copy of these resolutions be conspicuously displayed in connection with the collections herein referred to, and the original papers referring to this matter be placed on file in the archives of the Academy.

In moving the adoption of the report, Dr. C. C. Parry addressed the Academy, as follows:

It is quite unnecessary to state before those here present that the donation now made to this Academy, of the J. Duncan Putnam entomological collection and library, represents no ordinary gift. Aside from its actual pecuniary value, which I have reason to know is not small, it is also important in inaugurating a policy that this Academy will hereafter require a full control of all the collections placed within its custody, and for which it is, in a measure, responsible. While I do not under-

stand it to rigidly exclude special deposits for temporary use or convenience for special studies, it does mean that no private collection, over which it has no control, can be accumulated in its limited space to the virtual exclusion of its own undisplayed material. This is so manifestly just that I do not see how any exceptions can be made to it.

When, several years ago, I was specially invited to deposit my botanical collections in a room of the Academy ostensibly designed for that purpose, in accepting, at the time, the courtesy offered, I clearly saw that if the collection, as I hoped and expected, would grow under my hand, its proper care and arrangement would require more room and attention than could be reasonably devoted to it in an institution including other and more popular branches of science. I therefore, at the proper time, quietly withdrew my collection from its temporary custody.

Since then, as is plainly to be seen, the Academy collections have largely outgrown the available room for their accessible arrangement and display. The library shelves are loaded down with unbound volumes that are virtually sealed books, and the damp, dimly-lighted basement is in request for storage or limited display of desirable collections. Of course, the first natural suggestion under such circumstances would be, why not appeal to the public, who are directly interested, for an addition to this building, properly to accommodate its constantly enlarging material for study or display. Let those who have heretofore "in the heat and burden of the day" carried this load of popular solicitation answer this suggestion. It would probably come in the form of "*Try it yourself.*"

Till our Davenport Peabody or Lick makes his appearance, we must be content to do the best we can with limited means, and the first exercise of economy will be to cut off outside expenses; hence, properly arises the policy of declining the custody of private collections.

That such a policy should immediately result in such valuable donations to our collections, as that now under consideration, could hardly be expected; but that it will eventually lead to such results is reasonable, from the fact that actual ownership implies special care and protection, and hence affords the best guarantee of an appreciative use of such donations.

But, to come back to the point that first started these suggestions: We have now placed in our hands the ownership, under reasonable conditions, of a most instructive and valuable collection of entomological material—historically interesting in its direct association with one who derived his earliest inspiration toward such pursuits in our associated membership; scientifically valuable in its profoundly thorough investigation and copious illustration—above all, memorable as a noble example to all of unselfish devotion to pure scientific pursuits. As such, let us gracefully accept it.

The report was adopted unanimously. Accompanying, were the written conditions under which the Academy becomes owner of the collection and books, signed by Mr. and Mrs. Putnam, as accepted.

A paper by W. A. Chapman, of Okolona, Arkansas, entitled "An Ancient Mine in Arkansas," was read and referred to the Publication Committee.

J. E. Lindsey elected to regular membership.

July 9, 1886.—Adjourned Meeting.

Vice-President C. E. Harrison in the chair; eleven members and one visitor present.

Dr. Parry presented a paper on "Harfordia; A New Genus of Eriogoneæ from Lower California." Received and referred to Publication Committee.

Mr. Fawcett, of the British Museum, being present, was introduced by Dr. Parry and invited to participate in the deliberations of the evening. Mr. Fawcett expressed great pleasure in being able to attend a meeting of the Davenport Academy of Natural Sciences, and especially in hearing the paper of Dr. Parry, which he regarded as a very valuable contribution to botanical knowledge. He then proceeded to give, in response to inquiry, a very interesting sketch of the British Museum—its origin, gradual growth, present dimensions, character of buildings, management, means of support, etc. Mentioned that one special feature of the management was the fostering of special collections in local societies, great attention being given to illustrating local flora and fauna and local archæology; also to forestry. Attention had been forced to the latter by the great destruction of forests and consequent change of climate in some parts of the British Empire, notably in India, where the Forest Department is very strict and requires that wherever a tree is cut down another shall be planted in its place.

Mr. Pratt then read a paper on "Aerial Navigation," which was followed by a general discussion.

August 10, 1886.—Trustees' Meeting.

President C. E. Putnam in the chair; eight members present.

Mr. Pratt called the attention of the Trustees to the desirability of prosecuting more actively the work of mound exploration, and, after considerable discussion as to ways and means, a resolution was adopted providing for the appointment of a committee of three to solicit subscriptions for the work. Messrs. G. P. McClelland, E. P. Lynch, and James Thompson were appointed such committee.

On motion, the Treasurer was instructed to reimburse the Curator for expenses connected with his trip to the Marshalltown bed of Crinoids.

A letter was read from Dr. P. J. Farnsworth, of Clinton, Iowa, in regard to mounds of Albany and Fulton, Illinois.

The following bills were allowed and ordered paid: Repairing roof, $15.50; trays, etc., $3.00; postage, $75.00.

July 30, 1886.—Regular Meeting.

President C. E. Putnam in the chair; twelve members and a number of visitors present.

Curator reported some very valuable additions to the museum, the most notable of which was a collection of sixty-three species of fossils from the Paris basin, by Prof. Barris; and a number of exceedingly beautiful specimens secured by himself on a recent trip to the crinoid beds of Marshalltown.

Prof. Hatch reported a trip to the Ozark Mountains, and collections in botany and zoölogy.

S. M. Tracy, Professor of Botany in the University of Missouri, being present, was called upon, and made a few remarks in a very pleasant and complimentary strain, commenting on the advantages enjoyed by the members of the Davenport Academy.

Drs. Hoepfner, Jaenicke, and Matthey, and Mr. M. H. Calderwood, of Eldridge, were elected to regular membership, and Mr. C. T. Simpson and Rev. J. P. MacLean as corresponding members.

H. A. Pilsbry presented a paper describing "A New Hydrobinoid Mollusk, with Notes on Other Rissoidæ."

Mr. Pilsbry also gave an interesting account of some "plants" of mollusks near Davenport. During a recent collecting trip to Sylvan Water, he found a mollusk new to the Mississippi River. On showing it to the Curator of the Academy, he was referred to Academy Proceedings, Vol. II., p. 26, where an account is given of Mr. Pratt having brought from Peoria, Illinois, fresh-water shells not found in this vicinity, and transplanting some of the living shells into Sylvan Water. Mr. Pilsbry's findings, ten years later, show that their new station proved favorable to the mollusks. He further desired to have recorded the planting of a land mollusk, *Mes. Alholabris*, on the Island, the specimens being from Des Moines.

In view of the approaching National Convention of the Agassiz Association, to be held in this city, the Academy voted to appoint committees to coöperate with the local Agassiz Clubs in any way which might be conducive to the success of the meeting.

August 2, 1886.—ADJOURNED MEETING.

President C. E. Putnam in the chair; twelve members and a number of visitors present.

Dr. Preston read an account of the exploration of a number of mounds near Toolesboro, Iowa, made on July 24, by a body of Academy members consisting of Messrs. E. P. Lynch, C. E. Harrison, H. C. Fulton, and himself. (Published in Vol. V., pp. 17–44).

On motion, the thanks of the Academy were returned to the citizens of Toolesboro for aid rendered the exploring party.

Resolutions were unanimously adopted of hearty support and coöperation with the State Convention of the Agassiz Association, to be entertained by the Davenport Chapter, August 24, 25, 26, 27.

Mrs. Putnam reported the receipts of the "Woodlawn Fete" for the benefit of the publication fund, to be $126.15.

August 27, 1886.—REGULAR MEETING.

Vice-President C. E. Harrison in the chair; seventeen members present.

The following persons were elected to regular membership: Geo. E. Copeland, William C. Stevens, Herman Smith, A. Warnebold, E. A. Stanton, Thomas H. Jappe, W. M. Lillis, Dr. A. B. Dennis. For corresponding members: Prof. F. Starr, Cedar Rapids, Iowa; Prof. S. M. Tracy, Columbia, Missouri.

A paper was then read by A. Hageboeck on "*Amphioxus Lanceolatus*," illustrated by drawings and diagrams.

Mr. Pratt read a paper by W. A. Chapman, on the "Ancient Grooved Rocks in Arkansas." Both papers were referred to the Publication Committee.

September 24, 1886.—REGULAR MEETING.

President C. E. Putnam in the chair; nineteen members, a number of the Agassiz Chapter, and several visitors present.

Donations of unusual value were reported by the Curator, including a very fine collection of fossils from Prof. Barris; crinoids from Crawfordsville, Indiana; marine shells from Mr. Riepe; fossil shells from Mr. Pilsbry; a fossil ammonite, weighing twenty-five pounds from W. A. Chapman; section of a marine shell from China, donated by Mrs. Gamewell; and a collection of large photographs of the ruins of Charleston, from Prof. McGee of the United States Geological Survey.

Corresponding members were elected as follows: Dr. P. J. Farnsworth, of Clinton, Iowa, Professor of Materia Medica, Iowa State University; Mr. B. F. Waller, of New Palestine, Missouri; and Miss Belle M. Gilcrest, of Des Moines, Iowa.

A letter and the advance sheets of an article for "Science," by Prof. McGee, in regard to theories as to the causes of the Charleston earthquake, and the character of the work of the United States Geological Survey at that point, were read; and presenting the Academy a set of eight large photographs of scenes in and about the city.

Dr. McCowen then read a paper on "Earthquakes," a concise history from 1606 B. C., a summing up of the different theories as to causation now in vogue, closing with suggestions as to how science may render good services to humanity in recommendations as to building materials, methods of construction, etc., so as to render comparatively harmless the slight shocks which visit the United States and which are becoming more noticeable as the country is more thickly settled.

Dr. Parry then read an interesting account, by an eye witness, of the earthquake at New Madrid, Missouri; and Mr. James Thompson, a newspaper article on earthquakes, by Proctor.

The photographs sent by Mr. McGee, and a large map prepared by Mr. Pratt, added much to a clear understanding of the situation in Charleston.

Blanks sent out by the United States Geological Survey for the collection of information in regard to earthquake shocks, were distributed.

October 29, 1886.—Regular Meeting.

President C. E. Putnam in the chair, eleven members present.

Hal. Decker was elected as regular member, and Messrs. B. F. Goss and E. J. Hemmings, of Pewaukee, Carl Dœrflinger, of Milwaukee, Wisconsin, and James Gurney, of St. Louis, Missouri, as corresponding members.

Letters were read from Prof. Starr, of Coe College, asking the loan of books; from Fred Stearns, Detroit, wishing exchanges; from Prof. P. J. Farnsworth, Clinton, and Miss Belle Gilcrest, Des Moines, acknowledging membership; from Captain Hall, asking a remittance to prepare and ship specimens he has collected.

A handsome case for the Entomological Collection was presented to the Academy in commemoration of the birth-day of J. D. Putnam, its former President. On motion of Dr. Parry, a vote of thanks was returned to Mr. and Mrs. Putnam.

A paper on "*Lastarriæa*" was presented by Dr. Parry and referred to the Publication Committee.

November 23, 1886.—TRUSTEES' MEETING.

President C. E. Putnam in the chair; ten members present.

Mrs. Putnam reported an effort on her part to raise an annual subscription of $400 a year, for five years, to provide for the support of the Academy, and obviate repeated appeals to the public.

On motion, it was voted that Mrs. Putnam's plan for providing an annual support fund has the approbation of the Trustees.

A course of lectures or parlor meetings by home talent was proposed, and Mr. Phelps and Major McClelland were appointed a committee of arrangements.

On motion, the thanks of the Academy were voted to Mr. Kuhnen for the donation of a stove.

November 27, 1886.—ADJOURNED MEETING.

President C. E. Putnam in the chair; nine members present.

Curator reported the receipt of a barrel and several boxes from Captain Hall, containing mound pottery, stone implements, and a number of human skulls.

Mr. Harrison read the report, prepared by Mr. Pratt and himself, of the mound explorations made by them at Toolesboro, October 18th, resulting in the finding of but few relics, among which were human bones in a bad state of preservation, one skull, and the frontal bone of another, remarkably flat, a finely carved, smooth, and symmetrical curved base pipe, and some turtle shell fragments bearing artificial markings.

Mr. Pratt read a translation, made by Mr. Riepe and himself, of an interesting and valuable paper by Dr. Max Uhle, of Dresden, read before the Berlin Anthropological Society, entitled "Concerning the Elephant Carvings in America." Dr. Uhle reviewed the attack on the Academy of Sciences made by the Bureau of Ethnology, and discussed the co-existence of man and mastodon on the western continent, giving strong support to the affirmative theory. On motion of Mr. C. E. Harrison, it was resolved that the thanks of the Academy be tendered Mr. Max Uhle for his paper, and for the strong support given to the position of the Academy.

Mr. H. A. Pilsbry read by title a paper entitled "Notes on a Collection of Texan Mollusca," which was referred to the Publication Committee.

Mr. Pratt mentioned the fact that the Trustees of the British Museum have presented Dr. W. H. Barris with a copy of their great monograph on all known *Blastoidea*. It is a large quarto, containing twenty full page illustrations, numbering over four hundred figures. The gift is in recognition of his work in the same department of Natural History, which is published in the Proceedings of the Davenport Academy of Natural Sciences of last year's issue. The blastoids described by Dr. Barris are fully recognized, and frequent reference made to his work.

A letter was read from Mr. Gass, giving an account of an exploration made by himself, of mounds on Turkey River.

The following regular members were elected: Prof. Jerome McNeil, of Moline, Illinois, and E. B. Sanders, of Davenport; and for corresponding member, Miss Sue McCowen, of Englewood, Illinois.

December 10, 1886.—ADJOURNED MEETING.

Vice-President C. E. Harrison in the chair; fourteen members and two visitors present.

Mr. Fulton opened the discussion of the evening on "Fuel," with a very complete *resume* of the different kinds, their qualities and sources. He dwelt particularly on the vast waste in mining, in transportation, in handling, and, finally, in burning; and made important suggestions as to how much of it might be avoided. He also spoke of the various recent inventions for preparing valuable fuel from the immense masses of waste accumulated in the mining regions everywhere.

The subject was discussed by Dr. Hazen, Dr. Preston, and Messrs. Williston, Witherell, and Harrison.

December 31, 1886.—REGULAR MEETING.

President C. E. Putnam in the chair; fourteen members present.

Curator reported the donation of fossils by Rev. J. Gass, and a collection of one hundred fifty species of Florida shells by Mr. C. T. Simpson, Ogallala, Nebraska.

The following papers were read by title and referred to the Publication Committee, viz.: "Description of four new species of Myriapods from the United States," by Prof. Jerome McNeil, of Moline; "List of Mollusca collected in Florida," by C. T. Simpson, of Ogallala, Nebraska.

The following regular members were elected: Messrs. Fred. Heinz, Herman Steffen, T. L. Sharon, Emil Vollmer, William Stricker, Joseph Evans, Dr. A. M. Bowman, Theo. Krabbenhoft, George Krabbenhoft,

H. Abel, Jr., Melchior Hubinger, Adam Hubinger, Miss Grace Haddix, Miss Flora Haddix, Mr. A. L. Mossman.

It was ordered that a vote of thanks be tendered to Mrs. Newcomb for the base-burner heating stove presented to the Academy.

January 5, 1887.—TRUSTEES' MEETING.

President C. E. Putnam in the chair; eleven members present.

Mrs. Putnam reported $330 pledged on the annual subscription.

Voted, To pay the following bills out of the first available funds:

Curator's Salary	$166 66
Postage and Stationery	117 62
Repairs	96 44
Pictures of ex-President	21 75
Captain Hall	6 60

The list of membership was revised by striking from the Treasurer's books those who have declined to pay their dues when called upon, and those who have removed from the city.

January 14, 1887.—ADJOURNED MEETING.

Vice-President C. E. Harrison in the chair; ten members present.

The subject for discussion, "Weather Prognostications," was opened by Mr. Pratt, and included a consideration of equinoctial storms, the relation of the weather to tides and sun-spots, etc. The discussion was participated in by Messrs. Thompson, Fulton, and Harrison.

The theory of "Color" was then discussed by Messrs. Fulton, Pratt, Jappe, and Thompson.

January 26, 1887.—ANNUAL MEETING.

President C E. Putnam in the chair; ninety-two members present.

The reports of the officers were read, as follows:

TREASURER'S REPORT.

GENERAL FUND.

Receipts.

Amount from former Treasurer	$ 6 62	
Dues from ninety-three members	279 00	
Back dues collected	60 00	
Dues for 1887	6 00	
Membership fees (twenty-four)	120 00	
Discount deposit, National Bank	250 00	
Proceeds of Woodland fete	126 15	
Contribution box, etc	27 11	
Interest from Endowment Fund	87 48	
Amount from Scott County Medical Society	6 50	$968 86

Disbursements.

Amount paid Curator	$370 00		
" " for fuel	88 05		
" " Graham	45 00		
" " janitor	55 00		
" " for gas	36 25		
" " for water	16 00		
" " Marshalltown crinoids	13 85		
" " for freight and express	42 33		
" " for stamps, supplies, and incidentals	50 24		
" " for pamphlet, "Elephant Pipes"	128 00		
" " for insurance	34 00		
" " for 1885 bills, per vouchers	62 05		
" " for interest, Davenport National Bank	8 75	—	$949 52
Balance on hand			$ 19 34

ENDOWMENT FUND.

Amount received from treasury			$ 36 77
" " " publication fund, per Mrs. C. E. Putnam			100 00
" " " subscription, Prof. Young			5 00
" " " J. E. Lindsay, life membership fee			50 00
Balance on hand			$ 191 77

Condition of Endowment Fund, January, 1887.

Old amount due from general fund			$ 112 50
Amount invested at 8 per cent			1,000 00
Amount in savings bank at 5 per cent			191 77
Total			$1,304 27
Less bills payable, note to Mrs. Newcomb, for purchase of four feet additional ground			320 00
Net balance to credit of fund			$ 984 27

SPECIAL MOUND FUND.

Received from private subscriptions			$ 65 00
Paid first Toolesboro expedition	$20 85		
Paid second Toolesboro expedition	33 15	—	54 00
Net balance to credit of this fund			$ 11 00

PRESENT FLOATING DEBT.

Due Curator, balance of salary	$130 00		
" Mrs. Putnam, audited account	75 75		
" C. G. Hipwell, audited account	33 50		
" McClelland & Co., audited account	62 94		
" Egbert, Fidlar & Chambers, audited account	42 62		
" Hastings, White & Fisher, audited account	21 75		
" Mrs. Putnam (furnished Captain Hall), audited account	6 60		
" Interest to Mrs. Newcomb	25 60		
" Davenport National Bank	250 00	—	$648 76

Less Offset.

Collectible dues (estimated)	$ 75 00		
Fees due from five members	25 00	—	100 00
Estimated deficiency			$548 76

Respectfully submitted,

G. P. McCLELLAND,
Treasurer.

RECORDING SECRETARY'S REPORT.

To the Officers and Members of the Academy:

During the past year the following meetings have been held: Regular, 12; Adjourned, 8; Special, 3; Annual, 1; Trustees', 8. Total, 32.

Average attendance for meetings of the Academy, 15.

Average attendance for Trustees' Meetings, 9.

Thirty-nine regular, and 18 corresponding members have been added during the year.

Three regular members have been transferred to the list of life members.

Died during the year, Professor Sheldon.

Thirteen scientific papers have been read during the year, and the following topics of general interest discussed at the adjourned meetings of the Academy: "Railroad Telegraphy; Electric Motors for Street Cars; Aerial Navigation; Earthquakes; Fuel; Weather Prognostication."

To sum up, there have been held during the year a greater number of meetings, with a larger general attendance and a greater number of scientific papers read, than for a number of years.

Respectfully submitted, Jennie McCowen, M. D.,
Secretary.

CURATOR'S REPORT.—Abstract.

To the Davenport Academy of Natural Sciences:

The past year has been one of unusual activity and of almost unprecedented accessions to the collections, both in quantity and quality —among which are: The J. D. Putnam entomological collections and cabinets; the Alfred Sanders geological, mineralogical, and marine specimens and corals; the C. E. Harrison geological and mineralogical collection; the Barris collection, comprising seventy species of rare and beautiful specimens from the Paris basin, thirty species of ammonites, fifty species of crinoids; collections of cretaceous fossils from Arkansas, sent by W. A. Chapman; clusters of Coal Valley calcite crystal, from William Johnson; superb crinoids in the slabs from Marshalltown; two hundred species of Florida shells from C. T. Simpson; six hundred species of shells from H. A. Pilsbry; seven barrels and one box of stone implements, pottery, and skulls taken from southern mounds by Capt. W. P. Hall; sixty-two New England historical relics from G. F. Daniels; pipes, cloth-covered copper axes, awls, pearl beads, obsidian, mica, etc., obtained from mounds near Toolesboro, on the Mosier-Mallory lands, by C. E. Harrison, H. C. Fulton, E. P. Lynch, and Dr. C. H. Preston. [The names of twenty-six other contributors are given.] There are fifty-one large cases of collections in archæology, history, geology, mineralogy, botany, zoölogy, crustacea, entomology, ichthyology, paleontology, ornithology, etc.

Respectfully submitted, W. H. Pratt, *Curator.*

LIBRARIAN'S REPORT.

The Librarian, H. A. Pilsbry, having removed to Philadelphia, the report on the library was presented by W. H. Pratt, acting Librarian. (Abstract.)

The register shows an accession, during the year, of 1958 publications, embracing the usual range of home and foreign exchanges and public documents, and including a great many valuable and some very rare works.

The Library Committee, during the past year, has adopted a plan for a card catalogue of subjects, and has it well started, so that this important work, which will more than double the availability and value of the library, can be carried on as time and circumstances will permit. Members were urged to aid in this work. More shelf room is also imperatively needed, and large numbers of pamphlets and serials should be bound as soon as practicable.

PUBLICATION COMMITTEE'S REPORT.—Abstract.

Completion of Volume IV., of 1,500 copies; distributed 702.

Receipts, $1,258.78; expenditures, $1,227.18.

Volume V., now in process of publication, will contain as frontispiece the portrait of the late Prof. D. S. Sheldon.

Mrs. M. L. D. Putnam, *Chairman.*

PRESIDENT'S ANNUAL ADDRESS.

By C. E. Putnam.

Ladies and Gentlemen:

In the history of a society, as in the life of an individual, these recurring anniversaries subserve an excellent purpose. Upon occasions like the present we break away from the bonds of routine, and, standing, as it were, on the mount of observation, we look back over our traveled pathway, note our failures, estimate our progress, and thus enter with renewed zeal and more intelligent purpose upon the accomplishment of our great work. In an honest review of the past there is promise of a hopeful future.

It will be my purpose, in this brief address, to estimate the mission and influence of the Academy, and to offer some considerations tending to establish its proper position among the educational institutions of the city and state. If, in the discussion upon which I am about to enter, I should give expression to some propositions which may conflict with established opinions, it will, of course, be understood that the writer is alone responsible.

Preliminary to the special discussion I have in contemplation, I will briefly review some of the principal incidents of the past year. Notable among these was the completion and distribution of Volume IV. of the Proceedings of the Academy. This publication has been very generally sent in exchange to scientists and scientific societies in this country and Europe, and has been everywhere received with especial

favor, and, not infrequently, with high encomiums. The publication of Volume V. of the Proceedings has also been commenced, with some valuable papers giving the results of original researches in geology, paleontology, botany, conchology, and archæology. The printing of this volume will proceed as rapidly as scientific papers are furnished the Academy, and provision can be made for the necessary funds to meet the expense. As will be seen from the very full and complete report of the Curator, there have been, during the past year, several valuable collections donated to the Academy, as well as considerable additions made to its museum through explorations conducted by its members. Among these it may be mentioned that several ancient mounds have been opened, and some exceedingly valuable relics added to our already large archæological collection. These relics, as well as the other additions to the museum, are particularly described in the Curator's report, and hence will here be passed without special mention. It will appear from the report of the Secretary that there have been held, during the past year, eight meetings of the Board of Trustees, and twenty-three regular and special meetings of the Academy, with an average attendance of fifteen members. It further appears that there has been a considerable increase in the membership by the election of thirty-two regular, and fifteen corresponding members. These statistics are referred to as indicating a growing interest in the work of the Academy. The report of the Librarian shows a large increase to the library during the past year, and as these publications contain all the recent researches in this country and Europe, they are of great scientific worth. The interesting fact should not be overlooked that these large additions to our library are the direct result of the publication of our Proceedings, and in actual value will far exceed the expense incurred by the Academy for printing and distribution. The library of the Academy is thus becoming one of the largest and most valuable in the west, and is greatly in need of binding and cataloguing, in order that this rich scientific literature may be brought within easy reach of all workers in science. This department deserves, and should receive, special attention.

In connection with the publication and distribution of Volume IV. of the Proceedings, it should be stated the paper upon "Elephant Pipes and Inscribed Tablets," which was included as an appendix, has been generally accepted as decisive of the controversy in vindicating the reputation of Rev. Mr. Gass, and in establishing the integrity of these interesting specimens as genuine mound relics. In addition to the strong support received from the distinguished scientists whose communications were published in the second edition of that paper, we have been encouraged by still further and more emphatic testimonials. Notable among the distinguished gentlemen abroad who have thus championed our cause, I may mention M. le Marquis de Nadaillac, of Paris, France, and Dr. Max Uhle, of Dresden, Prussia. The former, in a paper entitled "*Les Pipes et le Tobag*," makes special mention of the unfounded accusations of Mr. Henshaw, and maintains the great antiquity of man in America, thus removing a principal objection to

the genuineness of the pipes and tablets. This paper contains illustrations of one of the elephant pipes, as well as some others in the Academy museum. The paper of Dr. Uhle was especially devoted to these relics, and, indeed, is entitled "Concerning the Two Elephant Carvings from America." It was published under the auspices of the Berlin Anthropological Society, of which the distinguished Prof. Virchow is president, and contains excellent illustrations of both elephant pipes. Dr. Uhle thus refers to the paper issued under the auspices of the Academy:

"Mr. C. E. Putnam, of the Davenport Academy, in an article upon the Elephant Pipes in the museum of the Academy, which appeared in Volume IV. of its Proceedings, has replied to Mr. Henshaw's attack, and though many may not have seen it, it was received by the writer of this article, as was also the second edition, who therefore considers it his duty to help to bring it to a larger audience."

Dr. Uhle then proceeds to notice the facts connected with the discovery of the relics in question, and the circumstances involved in this controversy in these emphatic terms:

"Henshaw has sought, by falsely representing that the tail is wanting in both pipes, to make a point against their genuineness. But on the originals, as well as on the correct pictures of them, the tails are plainly visible. Moreover, Henshaw was not correctly informed of the circumstances of the discovery. The arguments against the genuineness taken from the circumstances fail absolutely. Hence, the whole attack has been very badly prepared, and the points upon which he principally based his charge of ungenuineness are altogether without foundation. The impression, therefore, which we receive from the reply of Mr. Putnam is the opposite of that from Mr. Henshaw's paper, and is favorable to the genuineness of both these interesting relics."

Inasmuch as these two gentlemen occupy a foremost position among living archæologists, their favorable judgments may reasonably be taken as decisive of this controversy.

In this review of the work of the Academy, I must not omit some mention of its business interests. These financial matters are of vital importance in promoting scientific research, and whether we delve in the deep strata of the earth, or explore the star depths of the universe, this "filthy lucre" becomes essential to our researches. The truly scientific man, accustomed, as he is, to precision in all his operations, should also be a good business man. It becomes us, therefore, in furnishing a report of our scientific work, to also present to the patrons of the Academy a good balance sheet, and whenever an indebtedness shall appear thereon, it should be made clear that it was wisely incurred, and represents true scientific progress. "Pay as you go" is a good rule for both societies and individuals, and yet indebtedness does not always indicate improvidence. Thus, at the close of the great civil war, the ledger of the nation exhibited an enormous deficiency, but, when turning to the other side of the account the government was found credited with the emancipation of a race, this very indebtedness appeared encircled with a halo of glory. So, too, when the Royal Society of England

found itself without sufficient funds to publish the great work of Sir Isaac Newton, and was compelled to accept the generous contribution of the noted astronomer, Edmund Halley, to enable it to give to the world the most wonderful discovery ever made on this planet, every dollar of the financial obligations thus incurred became radiant as a star. Thus it is, while the cash system furnishes a good rule of conduct, it is undoubtedly true that in the history of a scientific society exigencies may arise when it is justifiable to anticipate future resources, but ceaseless care should be observed that no indebtedness is incurred which can be set down by the most captious as improvidence.

It will be unnecessary for me to go over the financial details of the past year, as they have been clearly presented in the Treasurer's report. It appears therefrom that our stated income has been insufficient to meet all necessary expenses, thus leaving a small balance of indebtedness; but it is evident from the reports of the Librarian, Curator, and Publication Committee, that there has been no unwise expenditure. The generous patrons of the Academy have, however, recently inaugurated a scheme which will, in a large measure, relieve it of these small financial embarrassments. A subscription has been started, and has already received the signature of many influential citizens, whereby the subscribers obligate themselves to pay, for five years, an annual amount, the aggregate of which, with the sums received from yearly dues of members, will be sufficient to meet all ordinary expenses.

These financial drawbacks sometimes seem to be serious obstacles in our pathway, but in surmounting them it may be we are acquiring that hardihood which insures ultimate success. In moments of discouragement it will profit us to recall the like experiences of other and older societies which have become famous in the world's history. Take for example some of the well-known societies of London, England—such as the Royal Society, the Royal Institution, the Society of Arts, the Institution of Civil Engineers, the Chemical Society, the London Institution, the Birhback Institute, the Society of Telegraphic Engineers, the Museum of Practical Geology, the Statistical Society, and the Royal Geographical Society. All these famous institutions have been, like our own, inaugurated and conducted through private enterprise, and without government aid, with perhaps the exception of the last named, which has, I believe, received a small subsidy. In reviewing the history of these institutions we find their experiences not unlike our own, and the narrative of some of their financial difficulties reads like a page from our own records. Thus, in explaining the inability of the Royal Society to publish the immortal "Principia" of Sir Isaac Newton, it is stated as a reason that "the finances of the institution had been so terribly depleted that even the salaries of the regular officers were in arrears. Members did not pay their subscriptions, and some of them, like Newton, were specially exempted from payment of their yearly fifty-two shillings, on account of the inadequacy of their means." This great institution, however, surmounted all these financial tribulations, and became the leader in scientific progress throughout the world. So great and important, indeed, have been its achievements that in com-

menting upon its publications Mr. Huxley expressed the opinion that "if all the books in the world except the Philosophical Transactions were destroyed, it is safe to say that the foundation of physical science would remain unshaken, and that the vast intellectual progress of the last two centuries would be largely, though incompletely, recorded." Such experiences, and such triumphs, even at so great a distance, should allay all our discouragement, and inspire us with zeal and purpose to build up here in the far-away valley of the Mississippi, an institution which may become a beacon light throughout the scientific world.

The impression is extensively entertained that only those whose situation in life gives them abundant leisure can engage in scientific pursuits, and hence that a scientific man cannot at the same time be a practical business man. Without doubt these erroneous impressions have deterred many of those engaged in some of the industrial callings from taking an active part in scientific research. A review of the lives of some of the most noted scientific investigators will, however, reveal the fact that, like Hugh Miller, they have steadily pursued some one of the industrial callings, and have only given their leisure hours to scientific pursuits. Upon this subject the late Lord Brougham made these wise observations:

"Some of the great philosophers in all ages have been engaged in the pursuits of active life, and an assiduous devotion of the bulk of our time to the work which our condition requires is an important duty, and indicates the possession of practical wisdom. This, however, does by no means hinder us from applying the rest of our time, beside what nature requires for meals and rest, to the study of science, and he who, in whatever station his lot may be cast, works his day's work, and improves his mind in the evening, as well as he who, placed above such necessity, prefers the refined and elevating pleasures of knowledge to the low gratification of the senses, deserves the name of a true philosopher."

These earnest words of a great thinker should encourage all the sons of toil to select from among the many branches of science some one for special study; giving to it their morning and their evening hours, with their days of leisure, it will grow with wonderful rapidity. As they pass to and fro from their homes to their places of business, new truths will seem to beckon them onward, new revelations of nature will call them to higher realms of thought, and as one by one they master the secrets of creation they will learn the worth of being, and attain to the dignity of true manhood. The knowledge thus acquired will pass into their experiences like a benediction — lightening toil, assuaging trouble, and elevating life with a lofty purpose.

In this review I must not omit reference to the museum of the Academy, undoubtedly the largest in the west, and containing collections, especially in entomology, palentology, and archæology, which are of great scientific value. The care and classification of this large and increasing mass of material demands the constant attention of a zealous and skillful Curator, and thus entails upon the Academy the larger portion of its current expenditures. This Society has been for-

tunate in securing for this position, at an extremely moderate compensation, the services of an earnest and competent gentleman who, more than any other person, has contributed to the establishment of this institution on a firm and enduring basis. It must be borne in mind that the museum is thus maintained and thrown open to the public for the benefit of all students of science. It affords no income to the Academy, and entails only expense, and yet as an educational institution it is of inestimable value. No doubt it is true that scientific researches may be pursued, and new discoveries published to the world without the collection of a museum, and therefore we have to expect from the public, for whose benefit it is maintained, liberal contributions toward its support.

This line of thought suggests various inquiries it may be well to ponder. What is the meaning of the scientific enterprise in which we are engaged? Are the researches in which the members of the Academy are so profoundly interested pursued only through idle curiosity, or have they a practical purpose? Is our museum a mere curiosity-shop, or is it a leaf carefully translated from the great volume of nature? In seeking a solution of these deep questions it will be apparent that the Academy fills an important place in the advancement of culture, and that it and other like institutions are forerunners of the new and true education. As an adjunct to our public school system, the museum of the Academy can be made of inestimable value. It is well known to all investigators that the truths of science cannot be learned alone from books, but need to be verified by researches in the field and laboratory, and this it is that gives to the scientific collections in our museum their great educational value.

I will now ask your attention to a brief consideration of the practical value of scientific study. I refer here not so much to the inestimable worth of these researches in the discovery of pure truth, as to the influence of its discoveries in advancing the material well-being of the citizen, and thus strengthening the foundations of the state. It is related of Michael Faraday and Joseph Henry that they refused to reap any pecuniary reward from their great discoveries, and hence, as soon as their scientific researches attained a point where invention made them practically useful and gave them a commercial value, they then abandoned that field of study, assured that the large number intent on gain would complete the work, and themselves pressed onward, like veritable pioneers, toward the frontiers of knowledge, to again engage in the higher and more congenial employment of disinterested research. While it is doubtless true that to the earnest student of science the discovery of new truths is its own sufficient reward, still, in seeking to secure the adoption of physical research into the busy practical life around us, it is fitting that we should give appropriate consideration to the economic values of these science studies. Consider, then, for a moment, how intimately scientific discoveries, and the mechanical inventions which follow in their wake, are interwoven into the web and woof of our social, civil, and political institutions. Take, for example, from the circle of sciences some of its principal branches, like botany,

zoölogy, geology, mineralogy, chemistry, meteorology, astronomy, and the undulatory forces, light, heat, and electricity, and see how largely they contribute to the needs of our daily life, and the requirements of modern civilization. Thus, the discovery of magnetism and electricity has been followed by inventions which have given to humanity the telegraph, the telephone, and the electric light. By the telegraph, time and distance have been well-nigh obliterated, and nations, though separated by seas and continents, are now brought into hourly communication, and through the net-work of friendly relations thus woven round the earth, war has almost disappeared from human history. By the use of the telephone an entire community is enabled to engage in familiar conversation as though collected under one roof, and even the inhabitants of neighboring cities, without leaving their homes, may carry on with each other the ordinary transactions of business life. Thus, too, the discovery of the expansive powers of steam has been followed by mechanical inventions which have subjected it to human control, and made it "the drudge of civilization." This almost superhuman power now enters into all the industries of life, and, by increasing the productive power of labor, has elevated the race. It has been estimated that by the use of steam the resources of labor have been augmented a thousand-fold, and that, in the manufactories of Great Britain alone, "the power which steam exerts is equal to the manual labor of four hundred millions of men, or more than double the number of males supposed to inhabit the globe." So, too, by the use of steam in navigation, and for operating railroads, and the facilities thus afforded for rapid travel and transportation, trade and commerce have been widely extended over the vacant places of the earth, and thus large value given to hitherto vast unproductive areas. But for the net-work of railroads which cover our western prairies, these broad tracts now teeming with abundant harvests would be nearly valueless. So, also, researches in optics, with the aid of chemistry, have given us photography, and the Spectrum Analysis, which are among the most important discoveries of recent years. Photography is not alone the artist of society, but, as the aid of modern science, it goes into the far reaches of space to faithfully record the most evanescent of celestial phenomena, and into the depths of the sea to depict the strange secrets for the wondering gaze of man. The spectrum analysis, though less intimately associated with our daily lives, is no less wonderful. It gives us a deep insight into the elements of the earth, and reveals the composition of the heavenly bodies. This, as you all know, is accomplished through the decomposition of light, and thus, by a careful comparison of the spectra of earthly substances with those of the celestial bodies, astronomers have been able to detect many of the materials of which they are composed. So, also, the recent researches in anatomy, physiology, and hygiene, have been of inestimable value to the race. By the information thus acquired concerning the organs of the body, their functions in the economy of life, and their proper care and treatment, ills have been removed, disease brought under control, and life itself greatly prolonged. As a direct result of this scientific progress, it is claimed that "as large

a number of persons now live to seventy years as lived to forty three hundred years ago," and, in striking confirmation of this, it is a well-known fact that the British government, in the management of its system of annuities, which is based upon the average of life, was, some years since, in consequence of this prolongation of life, compelled to revise its calculations. It may be mentioned, in this connection, that it has been claimed that the single discovery of the anæsthetics is of greater value to the human race than all the arts, literatures, and achievements of ancient civilizations. The passing glimpse we have thus taken of the great practical advantages resulting from scientific study, while necessarily meagre and imperfect, will sufficiently reveal the transcendent importance of these researches, and justify us in claiming for science a prominent, if not first place, in any general system of education.

When we contemplate the enormous progress made in scientific discovery during recent centuries, we are led to inquire as to the causes which have set in motion this great movement, and, not without reason, we look to our institutions of learning — our universities, colleges, academies, and seminaries — for the instrumentalities which have inspired this study of nature, and produced the extraordinary developments of modern science. When, however, we come to examine the curricula of these institutions, we find that, with, perhaps, the exception of the German universities, they have given but little or no aid to scientific research. Strange as it may seem, it will be disclosed that the remarkable advances made in scientific research and discovery have been almost entirely accomplished through individual zeal and enterprise, and through scientific societies and academies established and maintained by private munificence. The great universities of England and America have devoted their energies mainly to the study of Greek and Latin, and the other scholastic branches usually included in a classical course, and have left science to shift for itself. It will further be found that the example set by these great institutions has reached down through all the gradations of educational organizations, and influenced even the course of study in our public schools. I am not disposed to undervalue a classical education, and readily concede the worth of these linguistic studies in giving exactness and elegance in the use of language. I am free to admit that the clergyman, the physician, the lawyer, the journalist, and the scholar trained for literary pursuits, if they do not find them essential, will derive benefit from these classical studies. I am, however, impressed with the conviction that the English language, which furnished a sufficient vocabulary for Shakespeare, Addison, Goldsmith, for Lowell, Longfellow, and Bancroft, should be ample for the graduates of our public schools, and that the study by the pupils in these schools, of all foreign languages, dead or living, is not only a sheer waste of time, but a culpable perversion of the system. I therefore maintain that these branches should be dropped from the curriculum of the public schools, and that there should be substituted such instruction at least in anatomy, physiology, hygiene, as will induce correct living, such skill of hand as will fit its graduates for some industrial calling, and such knowledge of civics as will secure intelligent citizenship.

In connection with this subject of scientific education, it will be remembered that during the past summer there assembled in this city the National Convention of the Agassiz Association of America, an organization mainly composed of pupils from the public schools and students in college, and having for its principal object the study of the natural sciences. All who attended the proceedings of this convention must have been struck with the decorum of its deliberations, and greatly impressed with the accuracy of their knowledge and the wide scope of their researches. It was certainly an extraordinary spectacle, and the fact such a movement had become necessary to accomplish objects so eminently desirable is, in itself, a most complete and emphatic condemnation of the existing systems of education. Who ever heard of conventions being held to encourage and promote the study of Latin, or Greek, or grammar, or logic, or rhetoric, or geography, or history, or any other kindred studies usually found in the curricula of our educational institutions? It is only left for neglected science to thus force itself into prominence and place.

This review of the work of the Academy would be incomplete without some reference to the great question of religion as connected with the researches of science. It has been wisely provided that topics of a partizan or sectarian character shall not be introduced into the discussions of the Academy, but inasmuch as no nation nor race has ever been found on this planet without some form of worship, the anthropologist must needs accept religion as a scientific fact. It is usual, I know, to approach these questions with bated breath, and to handle them with a velvety touch, but I am unable to see why God's word should be more sacred than his works, or why His creation is less entitled to reverence than His revelation. If these relations have been unfriendly, it is because of empiricism in science and bigotry in religion. The severe student of science, it is true, may find that his mathematical training will not enable him to unravel the tangle of the trinity, that his mastery of logic is wholly inadequate to the reconciliation of foreknowledge, free-will, and predestination, and that his profound study into the wise adaptations and beautiful harmonies of the created universe disclose no fitting place for the location of that abyss of eternal fire said to have been provided for intellectual unbelief, and thus when he tears down these "fine spun ecclesiastical cobwebs," he too often makes the mistake to throw away with them all religion, but he should consider that its essentials still remain, the incentive to good conduct and correct living, reverence for God's work and word, and the expectation of immortal life. On the other hand, when Tyndall tells of matter so richly endowed as to have in it "the promise and potency of all life," and when Huxley announces that protoplasm is the common foundation of all forms of life, and when Darwin seeks to account for "the origin of species" by his famous hypothesis of evolution, the ecclesiastic in his fright cries aloud against the scepticism of science, but he should consider that the beautiful phenomena disclosed by their researches only add to the unexplained wonders of creation, and do not touch the mysteries of time and space, of matter and mind,

of the origin and destiny of man. It thus appears that the scientists and ecclesiastics are working on parallel lines, toward the solution of the same problem — the one seeking the true interpretation of God's revelation, the other of God's creation, and while there have been religious bigots who have burned the Brunos, and persecuted the Galileos of science, it is no less true that there are also scientific "bigots" who, because of some errors of ecclesiasticism, seek to destroy all religion.

In now retiring from this honorable position, I will call attention to the fact that the wise practice has prevailed in the Academy of observing the rule of annual rotation in filling the office of President, and I believe the only departure from this custom since the reorganization of the institution was at the last election, when, because of the controversy then pending, it was deemed desirable to continue the management. The proceedings of this meeting, therefore, will conclude my second term in the position of President, and I am gratified at being able to state that, through the energy and zeal of its active members, the interests of the Academy have been greatly advanced during this period, and that this society now occupies an enviable position in the world of science. The high rank it has attained, however, entails upon its members increased responsibilities, and should inspire them to engage only in genuine scientific work. The standing of the Academy has now become so conspicuous, and its proceedings so closely watched, its members cannot afford to relax their efforts, or lower their aim, but should labor earnestly, honestly, persistently, to retain its advanced position, and so to realize the high ideals entertained by the founders of the institution.

The election of officers was next in order, and balloting resulted as follows:

President — Charles E. Harrison.

First Vice-President — J. B. Phelps.

Second Vice-President — Dr. L. French.

Recording Secretary — Dr. Jennie McCowen.

Corresponding Secretary — Charles E. Putnam.

Treasurer — Nicholas Kuhnen.

Curator — W. H. Pratt.

Librarian — H. A. Pilsbry.

Trustees — 1st, Prof. W. H. Barris; 2d, G. P. McClelland; 3d, J. B. Phelps; 4th, C. E. Putnam. To fill vacancy, W. H. Pratt.

Mr. Harrison was then escorted to the chair, and in a few well-chosen remarks thanked the members for the honor conferred upon him.

A rising vote of thanks was extended to Mr. Putnam for the ability with which he has guided the affairs of the Academy during the two years of his incumbency.

January 28, 1887.—Regular Meeting.

President C. E. Harrison in the chair; thirteen members present.

A letter was read from Prof. O. W. Collett, of St. Louis, stating that Mr. Henry Shaw, of that city, had recently purchased and presented to the Missouri State Historical Society the very valuable library of the late Bishop Robertson; and, on motion, the following resolutions were unanimously adopted:

Whereas, We have learned with great satisfaction of the recent purchase of the very valuable library of the late Bishop Robertson, and the presentation thereof to the Missouri State Historical Society, by Henry Shaw, of that city; and

Whereas, Such generosity and true appreciation of the said society as the worthy and suitable custodian and owner of such precious documents, and the recognition of the value of such institutions as conservators of true history and aids to study and research, seem to us to be of much more than local importance; and

Whereas, Such conspicuous and noble examples must tend to attract the attention of public-spirited individuals everywhere, and to induce those who are able to contribute of their abundant means to the building up and support of worthy historical and scientific institutions in their own localities; therefore

Resolved, That we hereby tender our most hearty thanks to Mr. Henry Shaw for his munificent gift to the Missouri Historical Society, of a collection of rare books, whose great value will increase with time; and we desire to express and record our high appreciation of his far-seeing and wise liberality.

Resolved, That these resolutions be given to the city papers for publication, and copies of the same be sent to Mr. Shaw and to the Missouri Historical Society.

The following resolution, offered by Mr. Putnam, was adopted:

Resolved, That a special committee of three be appointed, to make careful examination of the Constitution and By-Laws of this Academy, in connection with the various amendments thereto which have been from time to time adopted, and to report such modification or revision thereof as may seem essential or desirable, together with such additional provisions as they may deem proper to recommend.

The chair appointed as such committee, Messrs. C. E. Putnam, Dr. C. H. Preston, and J. H. Harrison.

Mr. H. C. Fulton read a paper on "Words," reciting numerous curious instances of the adoption and use in English of various Anglo-Saxon and Latin words and their derivatives.

The President then announced the following committees for the ensuing year:

Finance.—Nicholas Kuhnen, Charles E. Putnam, G P. McClelland.

Publication.—Mrs. M. L. D. Putnam, Prof. W. H. Barris, Dr. C. H. Preston, James Thompson, Dr. C. C. Parry.

Museum.—W. H. Pratt, archæology; W. H. Barris, paleontology; W. H. Hatch, icthyology; Jerome McNeil, entomology; H. A. Pilsbry, conchology; William Riepe, history.

Library.—H. A. Pilsbry, H. C. Fulton, Charles E. Harrison.

January 28, 1887.—TRUSTEES' MEETING.

President C. E. Harrison in the chair; eleven Trustees present.

On motion of Mr. Fulton, the services of Mr. Pratt, as Curator, were retained, at $500 per annum.

Voted, that the Finance Committee be authorized to fund the floating debt of the Academy.

February 23, 1887.—TRUSTEES' MEETING.

President C. E. Harrison in the chair; nine Trustees present.

Mr. W. H. Pratt elected Deputy Treasurer.

The following bills were presented, and ordered paid out of the first available funds:

Glass & Axtman	$9 10
Robert Clayton	2 80
A. J. Lerch & Bro	2 75

February 25, 1887.—REGULAR MEETING.

President C. E. Harrison in the chair; nine members present.

The following persons were elected to regular membership: Messrs. F. E. Pomeroy, John N. Greer, W. C. Preston, Henry Vollmer, Joseph Allen, H. W. Techentin, J. W. Bollinger. The following corresponding members were elected: Miss Olive E. Coffeen, Minneapolis, Kansas, and George P. Hoerring, Iowa City, Iowa.

The committee on the revision of the Constitution and By-Laws reported as follows:

TO THE DAVENPORT ACADEMY OF NATURAL SCIENCES:

The undersigned, appointed a special committee to revise the By-Laws of the Davenport Academy of Natural Sciences, in the performance of the duty assigned them, have thought it best to also include some unimportant verbal modifications in that part of the Constitution not included in the Articles of Incorporation; and which said revision of the By-Laws and Constitution, as prepared by your committee, is herewith annexed.

CHAS. E. PUTNAM.
C. H. PRESTON.
J. H. HARRISON.

CONSTITUTION

OF THE

DAVENPORT ACADEMY OF NATURAL SCIENCES.

(The following Constitution includes the substance of the Articles of Incorporation adopted January 9th, 1875, and amendments thereto adopted January 2d, 1878):

Article I.—NAME AND OBJECT.

Section 1. This society shall be known as The Davenport Academy of Natural Sciences, and shall have for its objects the increase and diffusion of a knowledge of natural sciences, by the establishment of a museum, the reading and publication of original papers, and other suitable means.

Article II.—MEMBERS.

Section 1. This society shall consist of regular, honorary, and corresponding members, who shall be elected in such manner as the By-Laws may prescribe.

Section 2. The right of voting and holding office shall be confined to regular members, but honorary and corresponding members shall be entitled to all other privileges.

Article III.—OFFICERS AND TRUSTEES.

Section 1. The officers of the Academy shall consist of a President, two Vice-Presidents, Corresponding Secretary, Recording Secretary, Treasurer, Librarian, and Curator.

Section 2. The President, Recording Secretary, and Treasurer, with twelve (12) other members, all of whom must be residents of Scott County, Iowa, shall form a Board of Trustees for the management of the business of the Academy and to conduct its proceedings, and a majority of such members shall constitute a quorum for the transaction of business.

Section 3. The officers and four members of the Board of Trustees, to serve three years, shall be elected by ballot, at the annual meeting on the first Wednesday of January in each year, and must receive a majority of the votes cast—only one officer or trustee being elected at each balloting. In case of a vacancy, caused by the death or resignation of any officer or Trustee, an election shall be held to fill the same, at the next meeting after the announcement thereof is made.

Article IV.—ACQUISITION AND MANAGEMENT OF PROPERTY.

Section 1. The Academy may receive, hold, and manage all property acquired by gift or purchase, necessary or proper to promote its objects.

Section 2. No contract for the purchase of real estate shall be entered into, nor shall any improvements thereon be made, nor shall such property of the society be sold, except in accordance with the affirmative vote of a majority of the members of the society, present at a special or business meeting held after due notice given, specifying the objects thereof.

Article V.—BY-LAWS.

Section 1. The Board of Trustees, subject to the approval of the society, shall have the power to make all needful By-Laws, Rules and Regulations for the purpose of carrying out the objects of the society and conducting its affairs, and not inconsistent with the Constitution and Articles of Incorporation.

Article VI.—JOURNAL OF PROCEEDINGS.

Section 1. A Journal of the Proceedings, By-Laws, Rules, and Regulations, and an account of all receipts and disbursements, shall be kept by the Secretary and Treasurer for the inspection, at all times, of the members of the society.

Section 2. At the annual meeting, the Board of Trustees shall make a written report of the proceedings, which report shall embrace a full statement of the business affairs of the society.

Article VII.—AMENDMENTS.

Section 1. The provisions of the Articles of Incorporation, as provided therein, may be amended at any regular meeting of the Academy by a vote of two-thirds of the members present; *provided*, the proposed amendments have been presented to the Board of Trustees, in writing, at least one month prior thereto, and notice thereof published in some newspaper in the city of Davenport, stating the substance of the proposed amendments. The Board of Trustees shall present to the Academy any amendment thus offered, with a report on the question of its adoption, and with such modifications as they may see fit to recommend.

Section 2. The provisions of the Constitution, not embraced in the Articles of Incorporation, may be amended at any meeting of the

society by a vote of two-thirds of the members present, but the proposed amendments must have been presented to the Board of Trustees, in writing, at least one month before the day of meeting. The Board shall present to the Academy any amendment thus offered, with a report on the question of its adoption, and with such modifications as they may see fit to recommend; but no additions or amendments to the Constitution inconsistent with the Articles of Incorporation shall be made, except as herein before provided for amendments thereto.

BY-LAWS.

(As revised and adopted March 25th, 1887.)

ARTICLE I.—DUTIES OF OFFICERS.

Section 1. The President, or in his absence or inability to serve, one of the Vice-Presidents, in their order, shall preside over the meetings of the Academy and Board of Trustees; shall nominate all committees other than those specially excepted, and call such special meetings as he may deem necessary, or as he may be requested to call by the members. He shall, at the annual meetings, make a report on the condition and progress of the Academy, in all its departments.

Section 2. The Corresponding Secretary shall conduct and preserve the correspondence of the Academy; keep correct copies of all letters written on the business of the Academy; acknowledge the receipt of all donations from persons who are not regular members of the Academy; notify all corresponding and honorary members of their election, and keep a correct list of all such members, with the date of their election, and resignation or death.

Section 3. The Recording Secretary shall take and preserve correct minutes of the proceedings of the Academy and Board of Trustees in books to be kept for that purpose; shall have charge of all records belonging to the Academy; shall notify regular members of their election and committees of their appointment; shall keep a correct list of the members of the Academy, with the date of their election, and resignation or death; and shall notify regular members of all meetings and officers of all matters which shall occur at any meeting requiring their action.

Section 4. The Treasurer shall attend to all receipts and disbursements of the Academy, giving such bonds as the Board of Trustees may require, and shall make a general report, to be laid before the

Academy at the annual meeting, and at other times when called for by the Board, and furnish proper vouchers for such payments.

Section 5. The Librarian shall take charge of all books belonging to or deposited with the Academy; keep a catalogue of the library, in which the names of the donors shall be inscribed, with the dates of reception, and shall observe and enforce such regulations as the Board shall from time to time make for the use of the books.

Section 6. The Curator shall have charge of the museum and scientific collections of the Academy, assisted by such committees as may be appointed by the Academy. He shall superintend the exchange of duplicates, keep a record of all donations made to the museum, and report all additions at the annual meeting.

Section 7. The officers shall be elected by ballot, at the annual meeting, and must receive a majority of the votes cast — only one officer being elected at each balloting.

Section 8. In case of vacancy, caused by the death or resignation of any officer, the fact shall be announced to the Academy by the President at the next regular meeting thereafter, and an election to fill the vacancy shall be had at the next regular meeting after such announcement shall have been made.

Section 9. The Board of Trustees shall have control of all expenditures of money, make rules for the use of the library and museum, special rules for the Librarian and Curator, and shall have full power to act for the interests of the society, in any way not inconsistent with the Constitution and By-Laws.

ARTICLE II.—MEMBERS.

Section 1. Regular members shall be elected in the manner hereinafter prescribed, and shall pay an initiation fee of five dollars ($5.00). Candidates for regular membership must be recommended, in writing, by two reputable members, from personal acquaintance with applicant, and shall be proposed at a regular meeting, and balloted for at a subsequent regular meeting. All applications for regular membership must be in writing, subscribed by applicant and accompanied by the required initiation fee.

The business of the Academy shall be exclusively managed by, and its officers elected from the regular members; but no member shall be elected to office within the period of one year after his election to membership, nor thereafter if delinquent in the payment of his dues, or the performance of his duties as a member; nor shall a member be

allowed to vote within one year after his election, at the annual meeting for the election of officers and Trustees.

Section 2. Any regular member may, at any time after his election, become a *Life Member* by paying into the treasury of the Academy the sum of one hundred dollars ($100.00), and notifying the Recording Secretary that he desires to be enrolled as a life member.

Section 3. Any persons who may be interested in the study of natural science, or desirous of promoting the interests of the Academy, may be elected as corresponding members, and shall have all the privileges of regular membership except those of voting and holding office. Corresponding members shall be elected in the same manner as regular members, and may become regular members by notifying the Recording Secretary that such is their desire, and paying the initiation fee.

Section 4. Honorary members shall be selected from persons eminent for their attainments in science on whom the society may wish to confer a compliment of respect, and shall have all the privileges of regular members except those of voting and holding office. They shall not exceed forty (40) in number, not to exceed twenty (20) of whom shall be residents and citizens of the United States. Honorary members shall be elected only at the annual meeting.

Section 5. All members shall be elected by separate ballot and must receive the affirmative vote of at least four-fifths of the members present. Any rejected candidate shall have his initiation fee returned, and shall not be eligible for membership within one year after such rejection.

Any member in good standing may withdraw from the Academy by giving written notice of his intention to do so, and paying all arrearages due from him. Any member who shall neglect to pay his annual fee within one year after it becomes due, shall, upon being notified by the Treasurer, personally or by notice mailed to his last known address, and not paying within one month thereafter, forfeit membership; and any member who is thus delinquent shall not be entitled to vote at the annual or other meetings.

Members may be expelled from the Academy for cause, after a due hearing, by a vote of not less than two-thirds of the members present at any regular meeting.

Every regular member shall be subject to an annual fee of three dollars ($3.00), commencing on the first of January next following his election, and payable to the Treasurer, in advance.

The Board of Trustees may exempt a member from payment of fees when, from peculiar circumstances, they shall deem it for the interests of the Academy to do so.

Article III.—COMMITTEES.

Section 1. The Standing Committees shall consist of an Executive Committee, and Committees on Finance, on the Museum, on the Library, and on Publication. The President shall appoint all the standing committees, with the exception of the Executive Committee, at the annual meeting or the first regular meeting thereafter.

Section 2. The Executive Committee of the Board of Trustees shall consist of five members; and the President, Curator, Librarian, Recording Secretary, and Treasurer shall, *ex-officio*, constitute the same. This committee, under the direction of the Board, shall be empowered to provide fuel and other needed supplies, to order necessary repairs, to direct as to all ordinary matters of daily routine, and to exercise general supervision over the property and affairs of the Academy. The Executive Committee shall keep a record of their doings and expenditures, which shall be submitted to the Board of Trustees for review and confirmation.

Section 3. The Committee on Finance shall consist of three members, and it shall be their duty to take into consideration all subjects directly connected with the financial interests of the Academy; to recommend from time to time such action as may seem advisable for raising necessary funds for regular or extraordinary expenses, and at each annual meeting to present an estimate of the funds required for the ensuing year, with suggestions in reference to the best possible means of securing the same. The Treasurer shall be, *ex-officio*, a consulting member of this committee, and attend its meetings, but shall not be entitled to a vote therein.

Section 4. The Committee on Publication shall consist of five members, and shall from time to time cause to be published, and superintend the publication of, such papers read before the society, and such portions of the records of proceedings as may seem to them calculated to promote the interests of science, so far as the funds appropriated by the Board will permit.

Section 5. The Museum Committee shall consist of one member from each department of the museum, who shall assist the Curator in taking charge of and arranging all donations and deposits in their several departments, and shall carefully label each article.

Section 6. The Library Committee shall consist of three members, who shall have charge of all books belonging to or deposited with the Academy, and shall have power to make such exchanges of duplicates as may appear desirable.

Section 7. All committees must report in writing, and every report must be signed by a majority of the committee offering it. All special committees must report at the regular meeting next succeeding their appointment.

The President shall be, *ex-officio*, a consulting member of all standing committees, and authorized to be present at their meetings, but shall not be entitled to a vote.

Article IV.—MUSEUM AND LIBRARY.

Section 1. All members, and the public generally, shall have access to the museum at such times and under such regulations as the Board shall determine.

Section 2. No specimens shall be removed from the museum without leave of the Curator and committee of the department to which they belong, who shall take a receipt for the same and be responsible for their return in good order.

Section 3. The Rules and Regulations for the use of the library shall be printed and exposed in the library rooms.

Section 4. None but members of the Academy shall be entitled to the use of the library; but the Librarian may, at his discretion, permit persons not members to consult the books at the rooms of the association.

Section 5. Books on deposit shall not be taken from the Academy rooms without the consent of the owner, and periodical and new publications shall remain on the tables for one month after their reception.

Section 6. The Librarian or Curator may allow members to draw books from the library for the purpose of study, or in the preparation of papers, and when books are so drawn, the Librarian or the Curator shall record in a book for the purpose, the title of the volume, name of drawer, and date of drawing, and, on its return, the date of return.

Section 7. Books shall not be kept out longer than one calendar month at a time, and may be called in sooner by the Librarian.

Section 8. No person shall retain more than two volumes at any one time, and books returned shall not be redrawn by the same person before three days after their return.

Section 9. Holders of books keeping them out longer than one month at a time, or three days after notification to return by the Librarian, shall be liable to a fine of five cents a day for each volume so retained.

Section 10. If a book shall be lost, destroyed, or injured, further than by reasonable wear, the drawer shall be liable for the damages to the volume or set, as assessed by the Board of Trustees.

ARTICLE V.—MEETINGS.

Section 1. The Annual Meeting shall be held on the first Wednesday in January, at which time the election of officers for the ensuing year shall take place, and the reports of the retiring officers shall be heard.

Section 2. The regular meetings of the Academy shall be held on the last Friday of each month. Six members shall constitute a quorum.

Section 3. Special meetings may be called by the President whenever he may deem it necessary, or at the request of any three members, in writing. Field meetings and excursions may be held at such time and place as the Academy may direct.

Section 4.—The Board of Trustees shall meet on the first Friday in January, April, July, and October in each year, and at such other times as they may be called by the President, or any two members of the Board. Eight members shall constitute a quorum for the transaction of business.

Section 5. The Order of Business at regular meetings of the Academy shall be as follows:

1. Reading of Minutes of Last Meeting.
2. Reports of Officers.
3. Reports of Committees.
4. Donations to Museum and Library.
5. Deferred Business, Election of Members, etc.
6. New Business, Proposals for Membership, etc.
7. Written Communications.
8. Verbal Communications.
9. Adjournment.

ARTICLE VI.—SPECIAL PROVISIONS.

Section 1. In such points of order as are not determined in these By-Laws, the Academy shall be governed by the established usages of

similar institutions; and upon all questions of parliamentary usage, the Manual of Rules of Order, by Lieut.-Col. Henry M. Roberts shall be the standard authority.

Section 2. In case of the dissolution of the Academy, a meeting of the regular members shall be called, to decide on the disposition which shall be made of its property.

Section 3. No compensation shall be paid to any person whatever, and no expense incurred unless authorized by the Board of Trustees.

Section 4. The By-Laws of the Academy may be altered or amended at any regular meeting, by a two-thirds vote, provided that the proposition for such amendment shall have been presented at a previous regular meeting.

Article VII.—SECTIONS.

Section 1. Sections of the Academy holding separate meetings may be formed on the written application of five members, by consent of the Trustees.

Section 2. The requirements of membership shall be:

1. Membership in the Academy.
2. Written nomination by two members at a regular meeting of the Section.
3. Election by a three-fourths vote of the members present at a subsequent meeting.

Section 3. Notice of such proceedings as may be deemed of sufficient interest shall be given by the Secretary at the next regular meeting of the Academy.

Section 4. Sections shall have the exclusive right to make additional regulations for perfecting their organization, subject to the approval of the Trustees.

Article VIII.—ENDOWMENT FUND.

Section 1. There shall be established a fund to be known and designated as the Endowment Fund, and all money paid into the treasury for life memberships, and all money received from any other source and set apart for that especial purpose, shall constitute a permanent fund, of which the interest only shall be expended.

Section 2. The money so put into the treasury from time to time, shall be invested by the Finance Committee, under the direction of the Board of Trustees.

ARTICLE IX.—PUBLICATIONS.

Section 1. The regular publications of the Academy shall consist of Proceedings in octavo, and Memoirs in quarto. The Proceedings shall contain such original papers presented to the Academy and accepted by the Publication Committee as may be conveniently published in octavo form, together with such extracts from the records of the Academy as the Publication Committee may consider of sufficient interest to print. The Memoirs shall contain such papers as, on account of their size and illustrations, can best be published in quarto form.

Section 2. The Publication Committee shall fix the price upon the various publications of the Academy at which they shall be sold to members and the general public.

Section 3. There shall be established a permanent Publication Fund, the principal of which shall be invested in safe interest-bearing securities, and the interest only used. Any person contributing not less than fifty dollars ($50.00) to this fund shall be entitled to all volumes of the Proceedings issued thereafter during his life; and any person contributing not less than one hundred dollars ($100.00) shall be entitled to *all publications* of the Academy issued thereafter during his life.

March 11, 1887.—ADJOURNED MEETING.

President C. E. Harrison in the chair.

The subject for discussion was "Clouds—How Sustained in the Atmosphere." The subject was considered in detail, and the phenomena relating to storms in general was discussed.

March 25, 1887.—REGULAR MEETING.

President C. E. Harrison in the chair; nine members present.

Librarian reported one hundred seventy-eight additions to the library, including Volumes XV. and XX. of the Tenth Census Report, and two volumes of the scientific writings of Prof. Joseph Henry, former Secretary of the Smithsonian Institution.

Curator reported a number of additions to the museum, including a donation from Rev. J. D. King, of Fall River, Massachusetts, consisting of archæological relics, stone implements, shells of species now extinct, etc.

A communication was received from "*Science*," inviting the Davenport Academy to contribute to the ethnological department of that journal, notes of such work done by its members as would further the

growing interest felt in ethnology, the editor desiring to make a full monthly summary of work of scientific value done in this country.

On motion of Mr. Thompson, the invitation was accepted.

A communication was received from Mr. C. E. Putnam, resigning his position as Corresponding Secretary. The resignation was accepted, to take effect at the next regular meeting; and, on motion of Mr. Thompson, the following resolution was unanimously adopted:

Resolved, That in accepting the resignation of Mr. C. E. Putnam, as Corresponding Secretary, we desire to express our regret at the necessity which impels him to withdrawal; and our high appreciation of the valuable services he has rendered in his official relations with the Academy hitherto.

A paper from Prof. F. Starr, of Cedar Rapids, entitled "Bibliography of Iowa Antiquities," was received, and referred to the Publication Committee.

The report of the Committee on Revision of the Constitution and By-Laws was, on motion, taken up and read; the revised Constitution and By-Laws were considered, section by section, and, on motion, adopted.

April 15, 1887.—ADJOURNED MEETING.

President C. E. Harrison in the chair; eleven members present.

Mr. George H. French stated the object of the meeting to be the consideration and reply to a circular sent out by the Bureau of Agriculture, in regard to sparrows. It had been sent him by Prof. Barrows, Assistant Ornithologist in the Department, but he preferred, instead of personally responding to it, to bring the matter before the Academy of Sciences for consideration.

The questions propounded in the circular were considered seriatim, and the discussion was participated in by most of those present.

On motion, the Curator was instructed to fill out answers to the questions of the circular, giving the general drift of sentiment in this community in regard to the subject.

April 29, 1887.—REGULAR MEETING.

President C. E. Harrison in the chair; sixteen members present.

Librarian reported two hundred nineteen additions to the library during the month.

Curator reported a large number of donations to the museum.

Dr. C. H. Preston was nominated to fill the vacancy caused by the resignation of Mr. C. E. Putnam as Corresponding Secretary, and was elected by acclamation.

A communication was read from the ornithologist of the United States Department of Agriculture, Division of Ornithology, thanking the Curator for valuable information contained in his letter, and in the schedule filled out in regard to the English sparrow. He also expressed a desire to receive any further notes from time to time, which the Academy might collect upon the subject.

The Executive Committee reported that they had considered a proposition from Prof. F. Starr, professor of geology and biology in Coe College, Cedar Rapids, and one of our corresponding members, in regard to observations on the thunder-storms in Iowa. The Professor desired to prepare a report for Iowa, and would prefer that it should be done under the auspices of the Academy. As an immediate reply was necessary, the Executive Committee, at a meeting held April 18th, had accepted the proposal and promised the coöperation of the Academy. The correspondence with the Professor was read and the action of the committee approved.

Dr. Barris then introduced the subject of "Local Geology," basing his remarks on a pamphlet by Mr. A. S. Tiffany, which was filled chiefly with personalities and misrepresentations. Dr. Barris read from standard authorities at hand, showing the inaccuracies of various statements purporting to be scientific, and dwelt upon the fact that personalities were not legitimate criticisms of scientific productions.

The Doctor was asked to reduce his remarks to writing.

May 13, 1887.—ADJOURNED MEETING.

President C. E. Harrison in the chair; four members present.

Subject for discussion, "Thunderstorms." The meeting was entirely informal, and all members participated in the discussion.

May 27, 1887.—REGULAR MEETING.

President C. E. Harrison in the chair; six members present.

Librarian reported two hundred one additions to the library during the month.

Curator reported that the museum had received remarkable and extensive additions during the month, among which were six barrels, one keg, and seven large boxes of pottery and other relics from Arkansas, collected by Capt. Hall.

Mr. Pratt exhibited the thunder-storm blanks prepared for the use of observers, and reported progress as to this work.

Mr. Carl L. Suksdorf, principal of the German public school, and Mr. B. F. Thomas, editor of the *Morning Sun Herald*, were elected to

regular membership; Mr. L. G. Mason, Oregon, Illinois, was elected corresponding member.

A paper by Mr. R. Ellsworth Call was presented, entitled "Memoranda on a Collection of Fishes from the Ozark Region of Missouri." On motion, it was referred to the Publication Committee.

On motion, adjourned to the Academy grounds to view through the telescope, Jupiter, Venus, Saturn, and the new moon, all of which were in excellent position.

June 24, 1887.—Regular Meeting.

President C. E. Harrison in the chair; eight members present.

Librarian reported one hundred twenty-nine additions to the library during the month.

Curator reported large donations to the museum. A number of the most noticeable pieces of pottery of the late collection sent by Capt. Hall, and eleven crania, were exhibited.

A communication was read from Prof. Starr showing the thunderstorm work well in hand, with sixty present and eighty prospective observers, the only expense to the Academy being the printing of blanks, etc.

A communication was read from Clark Bell, Esq., President of the New York Medico-Legal Society, offering to send the Quarterly Journal of that society in exchange for the Proceedings of the Academy.

A paper was read from Prof. Starr containing an account of the exploration of four mounds in Floyd county, Iowa, under his immediate supervision. Referred, on motion, to Publication Committee.

Mr. Pratt gave an account of a large number of stone circles, similar to those described by Prof. Starr, inspected by him in Dakota, in localities where no trace of mounds or evidence of human presence, near or remote in time, was discernible.

Some interesting excerpts were read from a paper on "Fresh Water Animals," by Prof. Marshall, of the Manchester (Eng.) Microscopical Society, reciting a series of experiments carried on for the space of three years, which went to show that the differences between several distinct species of marine animals depend simply on the percentage of salt in the water in which they live. They were changed under the eye of the observer back and forth at will, by gradually adding fresh water to the tanks in which they are kept.

Prof. Pratt then brought up for discussion the subject of the "Spectra of Heated Iron."

July 21, 1887.—SPECIAL MEETING.

President C. E. Harrison in the chair; thirteen members and several visitors present.

Mr. Harrison stated the object of the meeting to be to take action on the loss which the Academy has sustained in the sudden death of the honored Ex-President, Mr. C. E. Putnam, which it was his painful duty to announce.

On motion, it was voted to meet at the Academy at 2:30 P. M., and attend the funeral services at the Presbyterian Church in a body.

The Secretary was instructed to make such announcement to members through the press and to send postal cards to the absent trustees.

On motion, the following committee was appointed to draft suitable resolutions, viz.: H. C. Fulton, J. H. Harrison, and Dr. McCowen. Committee was instructed to furnish a copy to the press, and to send one to the family.

A motion prevailed that the Academy be closed for thirty days out of respect to the memory of our late Ex-President, Mr. C. E. Putnam.

August 26, 1887.—REGULAR MEETING.

President C. E. Harrison in the chair; eleven members present.

The committee on resolutions relating to the death of Mr. C. E. Putnam reported the following resolutions, which were unanimously adopted:

WHEREAS, It has pleased the all-wise Creator of the Universe to remove by death our beloved and valued associate, adviser and friend, Charles E. Putnam, a benefactor of this Academy from its beginning, and late its honored President; therefore,

Resolved, That individually and collectively we, the members of the Davenport Academy of Natural Sciences, deeply feel the loss which has so heavily fallen upon us, as well as upon this entire community with which he has for so many years been prominently and honorably identified.

Resolved, That remembering his uniform and untiring efforts in behalf of this Academy, as well as in the interests of science in general, we will ever revere his memory and lovingly associate his name with those of Sheldon, Farquharson, and of his own gifted and lamented son, J. Duncan Putnam, who, having also served this Academy in its highest official station, have rested from their labors.

Resolved, That we extend to the bereaved widow and children, the tenderest and truest sympathy.

Resolved, That these expressions be spread upon the records of the Academy.

Signed, H. C. FULTON.
JENNIE MCCOWEN.
J. H. HARRISON.

After appropriate remarks by several of the members present, the regular order of business was taken up.

The Librarian reported three hundred five additions to the library since June.

The Curator reported large donations to the museum, of shells, fossils and curiosities of various kinds, and some of great scientific interest.

Mr. Pilsbry presented fifty mounted and labeled microscopic slides, showing the anatomy of the mollusk. Also, several hundred fishes of local species, being part of a collection which he, in connection with J. E. Elliott, of Rock Island, is making for the Academy.

The Publication Committee, through Dr. Preston, reported Volume V. well on the way, one-fourth of the matter being already in the hands of the printer, and enough to complete the volume waiting to be edited.

Two corresponding members were elected: Rev. Thomas L. Young and L. A. Cox.

A communication was read from Dr. Githins, Hamilton, Illinois, describing a worm-like creature thrown up by an artesian well at the Sanitarium at that place.

Edison's "Pyro-magnetic Generator" was then discussed. Mr. Pratt gave an account of the experiments leading up to this new discovery, and of the apparatus used. Much interest was manifested in the results which may be expected to result from this discovery.

The Academy then adjourned to examine Mr. Pilsbry's microscopical slides.

October 7, 1887.—ADJOURNED MEETING.

President C. E. Harrison in the chair; nine members present.

Librarian reported one hundred sixty-seven additions to the library.

Curator reported large number of donations to the museum.

The committee appointed to nominate a successor to the late Charles E. Putnam, as Trustee, reported the name of Mr. W. C. Putnam, who was unanimously elected.

A communication was read from the Humboldt Science Club, about to adjourn indefinitely owing to the departure from the city of a majority of its members, thanking the Academy for the use of the rooms, and for kindness and past favors. On motion of Dr. Preston, the vote of thanks was accepted and ordered to be recorded.

Lavinius W. Petersen, Jr., was elected to regular membership.

The death of Walker Adams was reported to the Academy, and a committee was appointed to draw up suitable resolutions.

October 28, 1887.—REGULAR MEETING.

President C. E. Harrison in the chair; nine members present.

Librarian reported one hundred thirty-five additions to the library.

Curator reported receipt of another box from Capt. Hall, containing one hundred thirty-one flint and stone implements and a few fossils,

A communication was read from Dr. Max Uhle, of Dresden, acknowledging the receipt of photographs sent him, and congratulating the Academy on the fact (which he had learned from scientific sources outside the Academy) that the opposition to the genuineness of the Academy relics had been, for the most part, abandoned.

W. H. Pratt, James Thompson, and Dr. McCowen, the committee on resolutions in regard to the death of Mr. Walker Adams, a life member of the Academy, reported the following resolutions, which were unanimously adopted:

WHEREAS, In view of the sad event which has recently stricken from the list of life members the name of Walker Adams,

Resolved, That in his departure from the scenes of busy life, the Academy sincerely mourns the loss of one of its life members and benefactors; and

Resolved, That we deeply sympathize with his family and friends in their great loss; and

Resolved, That a copy of these resolutions be spread upon the records of the Academy.

December 2, 1887.—ADJOURNED MEETING.

President C. E. Harrison in the chair; fourteen members present.

Librarian reported one hundred seventy-five additions to the library within the month.

Final report of Prof. Starr on "Thunderstorms in Iowa," was presented and on motion referred to the Publication Committee.

On motion, a committee consisting of Prof. Pratt, Dr. Preston, and H. C. Fulton, was appointed to formulate a plan for continuing the Thunderstorm reports.

It was reported that Prof. Starr's interesting and instructive costume lecture on the "Indians of Iowa" was given at the Presbyterian church under the auspices of the Academy, according to announcement.

A circular communication was received from the New York Academy of Science, asking coöperation in placing a monument over the grave of Audubon.

December 16, 1887.—ADJOURNED MEETING.

President C. E. Harrison in the chair; ten members present.

A paper by Mr. Charles R. Keyes, of Burlington, "An Annotated List of the Birds of Iowa," was read by title, and on motion referred to the Publication Committee.

Dr. Allen then gave an address on the "Vertebral System in Man and Animals," which was listened to with great interest.

On motion, a vote of thanks was tendered to Dr. Allen.

A box from Mr. George F. Daniels, of Oxford, Massachusetts, was then opened, and found to contain a large collection of ancient implements, household utensils, old china, etc.

January 4, 1888.—ANNUAL MEETING.

President C. E. Harrison in the chair; twenty-three members present.

The reports of the officers were presented, as follows:

RECORDING SECRETARY'S REPORT.—ABSTRACT.

Seventeen meetings have been held during the year, with an average attendance of fifteen. Seven regular and five corresponding members have been elected, making a total gain of twelve during the year Three life members, one regular member, and one corresponding member has died, making a total loss of five. Present membership—life members, 77; regular members, 120.

Papers of scientific value read before the Academy: "Bibliography of Iowa Antiquities;" "Report on Thunder-Storms of Iowa;" "Fishes of the Ozark Mountains;" "Annotated List of the Birds of Iowa;" "Anglo-Saxon and Latin Words."

Subjects of more or less general interest discussed: "Clouds, How Sustained in the Atmosphere;" "Theories of Thunder and Lightning;" "The Stone Circles on Dakota Plains;" English Sparrows;" "Theory of Color; "Changes in Animal Life Caused by Salt or Fresh Water;" "Edison's Pyro-Magnetic Generator."

Lectures: "The Vertebral System in Man and Animals;" and a costume lecture under the auspices of the Academy, "The Indians of Iowa."

Other societies holding meetings in the Academy building: Scott County Medical Society; Iowa and Illinois District Medical Society; Scott County Horticultural Society; Davenport Pharmaceutical Association; and two chapters of the Agassiz Association.

Number of visitors during the year, about two thousand.

JENNIE MCCOWEN, M. D., *Recording Secretary.*

LIBRARIAN'S REPORT.—Abstract.

The total number of additions to the library registered during the past year, exclusive of city papers, is 2,025. These comprise the transactions and reports of about one hundred scientific and historical societies in the United States and Canada, and one hundred and fifty foreign societies; the United States government publications, scientific, historical, and statistical, of eighteen of the several departments at Washington, received regularly; the geological survey reports of fourteen states, and the agricultural, historical, statistical, health, and other publications of nearly all the states, and a large number of miscellaneous scientific works. Of periodicals received regularly, there are eleven weeklies, one semi-monthly, seventeen monthlies, one bi-monthly, and four quarterlies. Of many of these we have complete files.

The library now contains — bound volumes, 1,730; unbound volumes and pamphlets, 4,600; miscellaneous scientific papers, 775.

A reading table is kept furnished with the publications recently received, which, as well as those on the shelves, are consulted during the open hours of the Academy almost every day; and citizens of nearly every nationality can find here valuable scientific works printed in their own native tongues.

The especial needs of the library are: a considerable increase of shelf-room; the binding of several hundred volumes; a lot of pamphlet cases; the completion of a subject catalogue, which is begun, and a fund for the purchase of such important works as are especially needed and cannot be obtained (as almost the whole library is, and always has been) by exchange for our "Proceedings." As the Academy is in no way a money-making institution, it is to be hoped that some public-spirited citizens will aid in providing for its needs.

Harry A. Pilsbry, *Librarian.*

TREASURER'S REPORT.

The Treasurer's report was presented by W. H. Pratt, Deputy Treasurer, as follows:

GENERAL FUND.

Receipts.

Amount from former Treasurer	$ 19 34	
Annual dues for 1887	270 00	
" " " 1888	3 00	
" " arrears	51 00	
" subscriptions for 1887	423 00	
Membership fees (seven new members)	35 00	
Contributions	28 01	
Interest on Endowment Fund	89 55	
" " Mound Fund	55	
" " temporary deposit	76	
For use of rooms	12 50	
Borrowed at National Bank	650 00	
Mrs. Newcomb's share of sewer bill	11 20	
Prof. Starr's lecture	13 05	— $1,606 96

Expenditures.

Amount paid Curator	$451 66	
" " janitor	60 00	
Fuel	50 25	
Gas	24 75	
Water	16 00	
Express and freight	46 64	
Postage, supplies, and incidentals	86 36	
Prof. Starr's lecture	10 75	
Subscription to "Science"	5 00	
Old note, taken up	250 00	
Old bills and accounts paid, per vouchers	398 09	
Paid on new note	200 00	
Balance on hand	7 46	$1,606 96

ENDOWMENT FUND.

Loaned on Mortgage, at eight per cent	$1,000 00	
Deposit in Scott County Savings Bank at five per cent	191 77	$1,191 77

SPECIAL MOUND FUND.

Deposit in Scott County Savings Bank	$11 00

PRESENT INDEBTEDNESS.

Note to Mrs. Newcomb, at eight per cent	$320 00	
Note to Davenport National Bank, at seven per cent	450 00	
Balance due Curator	48 34	
Unpaid bills	10 00	$828 34

Thus it will be seen that the balance of accruing interest is $33.00 per annum in favor of the Academy.

Probable collectible dues, $36.00.

The total current expenses for 1887 were $795.15.

NICHOLAS KUHNEN, *Treasurer.*

CURATOR'S REPORT.

In the Museum department, the accessions during the past year comprise the following: About three hundred vessels of ancient mound pottery; two hundred flint and stone implements; eleven human crania, from mounds; one carved stone Indian pipe; two hundred and thirty-five old-time relics from New England; an old electrical machine; twenty-five species of fossils; several hundred species of recent shells.

No additional cabinet cases have been supplied, and the need of them is extremely pressing. By the addition of four cases of the usual form, the alcove arrangement of the west room of the basement could be completed, and the whole room made available as a part of the museum; and some reasonable hope is entertained that this will soon be done.

The collection of recent shells, which has been very largely increased by the labors of Mr. Harry A. Pilsbry, has been rearranged, and extended to occupy two additional cases, and a catalogue of them nearly completed—about twenty-five hundred species.

A considerable number of the local species of fishes and reptiles has been collected and preserved, and during the ensuing year it is be-

lieved that considerable progress can be made toward making up an approximately complete collection. In gathering these and other natural history specimens, our young friends of the Agassiz Associations may be depended upon for considerable aid, and if their pursuit of the study should develop a competent taxidermist it would certainly supply a long-felt need.

Nothing has been done during the year in mound explorations in the interest of the Academy, except that prosecuted by Captain Hall along the Lower Mississippi, the collections from which have been added to the Academy museum and are referred to in the above enumeration. There remains plenty of that work to do within the range of fifty to seventy-five miles of us; but for that purpose some money is required, and it is only upon occasions not very frequent that the means can be secured. This work is, for us, of the utmost importance, in order to maintain our reputation for activity and perseverance, as well as for the actual knowledge to be gained.

For a better classification and arrangement in some departments — especially the minerals — a great improvement could be made, and some valuable space saved, if it were possible to remove restrictions requiring the individual collections to be kept as such. Instead of this, the specimens could then be better classified, and space in cabinets need not be taken up by duplicates.

I would not recommend that the increase of our museum greatly beyond its present extent should be a principal object, except, first, completed local collections, and, second, systematic, classified series in the various departments adapted especially for study, and kept for reference and use by members and by classes from the public schools, but not to be taken from the building. W. H. PRATT, *Curator*.

REPORT OF PUBLICATION COMMITTEE.

Volume V. of the Academy Proceedings was commenced, and a few pages printed, in 1886, as stated in last annual report. During the early months of the past year, all effort was directed toward raising a fund to secure the current expenses of the Academy; and later, the dark shadow of death in our midst sadly interrupted the work of the Committee, so that the printing of the volume was still delayed, and no subscriptions received until late in November. Nevertheless, all expense thus far incurred has been met, save a loan of one hundred dollars, without interest, which was kindly offered for the completion of Volume IV., and which the Committee assumed the responsibility of accepting. To carry on the work, it is important that members and others should promptly hand in their subscriptions.

Funds to provide a suitable portrait of the late Prof. D. S. Sheldon have been secured through the generosity of his former pupils and friends, and a biographical sketch is in process of preparation, and both will appear in Volume V.

Many valuable papers intended for this volume have been received during the year, of which the following — filling sixty-four pages — have been printed:

"On Certain Recent Quaternary and New Fresh-Water Mollusca." By R. Ellsworth Call; 8 pp., 1 plate, 3 cuts.

"On Pyrgulopsis, a New Genus of Rissoid Mollusks, with Description of Two New Forms." By R. Ellsworth Call and Harry A. Pilsbry; 6 pp., 1 plate, 1 cut.

"A Defense of Our Local Geology" (a criticism of Mr. Tiffany's pamphlet). By W. H. Barris; 8 pp.

"Volcanoes of the Sandwich Islands." By C. S. Watkins; 6 pp.

"An Ancient Mine in Arkansas." By W. A. Chapman; 4 pp.

"Description of a New Hydrobia, with Notes on Other Rissoidæ." By Harry A. Pilsbry; 2 pp., 1 plate.

"Lastarriæa (Remy) Confirmation of the Genus, with Character Extended." By C. C. Parry; 2 pp.

"Mound Exploration at Toolesboro, Louisa County, Iowa." By Messrs. Lynch, Fulton, Harrison, and Preston; 6 pp.

"Additional Explorations at Toolesboro." By C. E. Harrison and W. H. Pratt; 2 pp.

"Contributions to the Mollusca of Florida." By C. T. Simpson; about 25 pp., one-half printed.

"Memoranda on Some Fishes of the Ozark Region of Missouri." By R. Ellsworth Call; 8 pp.

Other papers in the hands of the Committee are as follows:

"A Report on Thunder-Storms of Iowa, Season of 1887." By Frederick Starr.

"Annotated List of Iowa Birds." By Chas. R. Keyes.

"Description of Four New Species of Myriapods from the United States." By Jerome McNeil; 2 pp.

"Ancient Grooved Rocks." By Wm. A. Chapman; 2 pp., 1 cut.

"Contributions to the Knowledge of the Devonian Fauna of Iowa, with a Description to the Rockford Shales." By Clement L. Webster; about 10 pp., 1 map, 1 cut.

"Mound Explorations in North-Western Iowa." By F. Starr.

These will be sufficient for Part I., of one hundred and fifty pages. It is our purpose to include in the second part of this volume the revised constitution and by-laws, list of members, and lists of donations; also a complete index to the entire proceedings to date; Prof. W. J. McGee, of the United States Geological Survey, having kindly offered to prepare the latter as soon as the work is ready. It will also contain a condensed report of the proceedings of meetings.

Mrs. M. L. D. Putnam,
C. C. Parry,
W. H. Barris,
C. H. Preston,
James Thompson,
Committee.

PRESIDENT'S ANNUAL ADDRESS.

By Charles E. Harrison.

Ladies and Gentlemen:

In surrendering the trust which in generous confidence you assigned me, I shall not be expected to offer any scientific discourse, neither will I undertake any apology for such shortcomings as could have been prevented only by elevating some abler member to this honorable office. The credit of whatever success may seem to have attended the direction of affairs, is due to the officers and members who have willingly assisted and advised, and for whose constant support, as well as forbearance, I am sincerely thankful.

The twentieth year of our existence, just rounded to a close, may be said to have been one of "even tenor," less fruitful, perhaps, of perceptible results than some preceding ones, but yet, I trust, a year in which we who remain have lost none of our interest in the grand work of seeking after truth for truth's sake—a year in which no retrogressive step has been taken, and which, notwithstanding the full quota of discouragements which it has witnessed, leaves us, I dare say, to-night, strong and determined to continue the good work which, springing up from the little seed so opportunely planted just twenty years ago, has continued to flourish and grow, and which, with increased possibilities as well as responsibilities, devolves now upon us as faithful members. To have thus long survived the various vicissitudes which have beset us, while a number of scientific associations in this and adjoining states have been organized and, after a short existence have ceased to be, is of itself an encouraging measure of success; and this result, which, though in no spirit of boasting, we may view with some just pride, is magnified when we consider that, notwithstanding adverse circumstances—particularly a constant lack of sufficient means to properly prosecute our work—the institution has steadily gained in popularity and strength, and to-day, owning the valuable premises it occupies, is enabled to keep its rooms open to the public, maintains the publication of its proceedings, and is building up in this accessible western city a scientific museum and library which must be, if properly sustained and wisely managed, a factor of much importance in the great scheme of educational progress.

That there is cause for anxiety for the future is true; for, except about $90 interest accruing from the nucleus of an endowment fund, a special annual subscription fund of $425 (limited to five years), and the meager receipts from dues and fees, say $350—a total of less than $900, or about sufficient to pay running expenses—the Academy is without funds for the purchase of such needed books, periodicals, and monographs as cannot be obtained by exchange and otherwise for the prosecution of its work. And then, as the years come and go, we are being rapidly deprived of our faithful workers and substantial supporters. New members are recruited from time to time, but these are not numerous; and have they, and have we, that zeal and efficiency which, added to lofty purpose, is essential to continued success? The Acad-

emy may be hereafter, as heretofore, hindered by lack of funds, and thus restrained may even bide its time until some philanthropist enables it to occupy a yet higher plane of usefulness. But we need, and must have, diligent workers, investigators, delving in the fruitful fields of scientific research, and seeking to know more of nature and of nature's laws. We may be glad that there is established in our midst two vigorous chapters of the Agassiz Association, comprising a goodly number of boys and girls ardently interested in and studying the various branches of natural science. This is a body of noble youth bending the young intellect into the pleasant and important paths of scientific inquiry, and whose very purpose is to us a halo of promise, gilding the Academy's future sky with a radiance of hope.

A very full condensed account of the year's transactions appears in detail in the several reports which have been read in your hearing, but some matters in connection therewith may claim especial attention.

The printing of Volume V. having been resumed and sixty-four pages issued from the press, it is highly desirable that the work be pushed forward, especially as there is already in hand sufficient material to complete the first part. To do this, we must largely rely upon the support of our own members, less than twenty of whom have as yet subscribed for copies. If each member would order one copy—certainly not a heavy burden—the completion of the book would be assured. The volume, in addition to proceedings and scientific papers, will be adorned with an excellent portrait and biographical sketch of our lamented fellow-member, Prof. D. S. Sheldon, the honored first President of the Academy, the expense of the plate being met by his former pupils and friends. Prof. W. J. McGee, of the United States Geological Survey, has kindly offered to prepare a complete index when the volume is ready, a work involving no inconsiderable amount of labor and skill.

The collections in the museum show large additions during the year, and the classification and arrangement of these accumulations, while giving much and very proper employment to our excellent Curator, has taxed his ingenuity as well, because of the insufficient accommodations and already crowded condition of the cases. The constant necessity for increase of room and greater facilities in the museum department, which has obtained and burdened the Academy for several years at least, seems to "grow with its growth," and current wants are scarcely, if at all, supplied till others appear. Nevertheless, the condition referred to is by no means cause for complaint. Such increase in either of its departments is, as a result, a legitimate part of the Academy's successful work, and the provision of a suitable depository for every specimen received is not only a necessity, but an imperative duty, which must be bravely met. The excellent suggestion of the Curator, viz.: the construction of four additional cases uniform with those now in place in the west basement room, to complete the alcove arrangement already begun, and thus render that commodious apartment wholly available for museum purposes, is worthy of adoption as affording much needed relief and of proper effort to provide the means for its execution.

The Librarian's report is encouraging as exhibiting no diminution in

the steady growth which has heretofore characterized this highly important department of the Academy. The addition during the year of more than two thousand publications comprising the transactions of most, if not all, the important scientific and historical societies of the world, the individual contributions to science of many eminent *savants* of the day, and a vast deal of other matter relating to scientific research or reflecting scientific thought, is surely a grand showing. And this single item is important to the good people of this community as indicating not only the vast value of the literary treasures already in store, but also the probable growth, and consequently the increasing worth, of the Academy's library. Here, too, as in the museum department, already alluded to, there is pressing want. These books and pamphlets, gleaming and glittering with living thought, cry out for proper place and proper protection. More shelf-room is needed; binding is needed; a complete index is needed; and in view of the scantiness of our treasury and other proper demands made upon it, one of the problems which now confronts us is how to supply these wants.

Let not the erroneous idea prevail that this great library and museum are for the exclusive use and benefit of our members. Both are available to the public, daily, during "open hours," and both are being consulted and examined almost constantly, often by pilgrims coming from afar for the express purpose. Surely, in this enlightened and progressive city, agencies of such vast educational utility and worth, of such widespread and far-reaching benefits to the entire public, and capable of maintenance at such comparatively little cost, cannot long await the day of fuller appreciation when the number of our good people whose names are enrolled as members of the Academy shall be far greater than at present.

The finances, while not in that flush condition desirable and necessary to greater accomplishments, and while yet comparing favorably with the condition of affairs at any annual meeting of recent years, is a subject of considerable concern inasmuch as this department of necessity underlies every other, and is of vital importance as affecting the progress and success of the Academy, or possibly its very existence. It has been necessary during the year to borrow the sum of $650; but when we consider that previous indebtedness amounting to $850 has been paid, there is no cause for discouragement in the item. The interest accruing from our investments is more than sufficient to pay for the use of this borrowed money, the difference in our favor being about $33. Still, it is desirable that the Academy be freed from debt, and this it is hoped to speedily accomplish by continuing the practice of strict economy and prudent management.

Having referred to the status and wants of the several departments as separate matters pertaining to the progress and condition of the Academy, I come now, with sad heart, to speak of the honored dead—of those strong helpers and fellow-workers whose labors and aid have left a lasting impress upon, or added additional lustre to, the good name of this beneficent institution. During the year, death has deprived us of three life-members, Charles E. Putnam, Walker Adams, and A. F.

Williams; one regular member, August Warnebold; and one honorary member, Prof. Spencer F. Baird. These were honored names upon the roll, and their several deaths within the period of one short year make up a total loss of crushing weight. Who of the large audience that sat in this room just twelve months ago and listened to the masterly address of the retiring President, Charles E. Patnam, could have dreamed that death would come so soon to him, the useful and respected citizen, the man of large attainments and noble purposes, the benefactor and defender of this Academy, who had so long and so liberally contributed of mind and means to its support and upbuilding, whose wise counsels and executive ability served us so ably and well through the two terms of his administration, and whose loss to the society, as well as to the entire community, is irreparable indeed. Because of his unswerving fidelity to this institution, his earnest solicitude for its success, and active interest in all that pertained to its affairs, and his known generous disposition and willingness to render assistance, it must be true that the inefficiency of his official successor would have been greatly lessened but for his untimely end. But, fellow-members, though we are weakened, saddened, and discouraged by the loss of these good men, we must not sit idly down to brood over the inexplicable dispensation of Providence.

The history of our twenty years experience in meeting and mastering obstacles, should inspire us anew with confidence, energy, and zeal. The grand work which has been brought thus far at measureless cost of solicitude and labor, and consecrated by the best efforts of the younger and elder Putnams, of Sheldon, Farquharson and others, is worthy of perpetuation. In the world's great struggle for universal education, and development of mind, the field for such beneficent institutions as this is ample and wide, and I trust the day is not far distant when every good public-spirited citizen—whatever his financial status or scientific attainment—charged with the electric spark of pure philanthrophy, shall rally to the support of this great instrument for the diffusion of knowledge, that this fair young metropolis throned upon the commanding bluffs of our own majestic river, boasting of every element of commercial dignity and greatness, boasting of her temples, colleges, and schools, may point with exultant pride to an enlarged, commodious and imposing building towering high upon this the sunniest spot of her southern slope—a building which shall be at once a monument to the enterprise, intelligence, and goodness of her people, a proper home for the Davenport Academy of Natural Sciences, and with its accumulated treasures a benefaction and precious heritage to generations yet unborn.

The presentation of these reports was followed by the election of officers for the ensuing year, resulting as follows:

President—CHARLES E. HARRISON.

First Vice-President—JOHN B. PHELPS.

Second Vice-President—DR. L. FRENCH.

Recording Secretary—Dr. Jennie McCowen.

Corresponding Secretary—Miss Lucy M. Pratt.

Treasurer—Charles D. Glass.

Librarian—H. C. Fulton.

Curator—W. H. Pratt.

Trustees for Three Years—W. H. Holmes, William Riepe, E. H. Hazen, W. H. Pratt.

C. R. Keyes was elected corresponding member.

The following resolutions, offered by Mr. Pratt, were presented, and unanimously adopted:

Whereas, We are informed, by notice from the Smithsonian Institution, that the vacancy caused by the decease of the late lamented Secretary of that Institution, Prof. Spencer F. Baird, has been filled by the appointment of Prof. Samuel P. Langley to that position.

Resolved, That we are highly gratified to learn that a gentleman of such acknowledged talent, eminent scientific attainments, and executive ability, and high character, has thus been selected for the important position of superintendent of the management of this, one of the leading scientific institutions of the world; and

Resolved, That we desire hereby to express our hope and full confidence that the uniformly pleasant and friendly relations which we have enjoyed for the past twenty years with his learned predecessors, Professors Henry and Baird, may continue undiminished between us and the new Secretary through many coming years; and

Resolved, That we take pleasure in hereby tendering to Prof. Langley the honorary membership in our institution heretofore held by the former secretaries.

January 10, 1888.—Trustees' Meeting.

President C. E. Harrison in the chair; nine members present.

On motion, it was voted that a committee of three be appointed to devise plans to increase the interest in the meetings of the Academy and the efficiency of its work in general, to report to the Academy as progress is made. The chair appointed Dr. Jennie McCowen, W. H. Holmes, and W. H. Pratt such committee.

On motion, it was voted to continue the services of Mr. W. H. Pratt as Curator, at $500 per annum.

January 28, 1888.—Regular Meeting.

President C. E. Harrison in the chair; six members and several visitors present.

Librarian reported one hundred forty-eight additions to the library.

Curator called attention to a very valuable report on "Cattle and Dairy Farming," among the consular reports now out of print. On motion, it was voted that W. H. Holmes and W. H. Pratt be a committee to prepare a suitable resolution to forward to Washington, asking for another edition to be printed.

The committee from the Board of Trustees to devise plans for increasing the interest in Academy work, asked leave to report as follows:

1. That it be determined and announced that, in addition to the regular monthly meetings provided for by the By-Laws, the Academy will be opened and a meeting will be held every Friday evening, and that all members be requested and the public invited to attend at all meetings, and that provision be made, as often as possible, for a lecture or paper and discussion on some subject of scientific or general interest. Also, that when no subject is announced, those who are present take up some subject, by reading published articles or otherwise, for regular discussion, and furnish the papers with a report of the meeting.
2. That printed cards of notice of meetings be filled out and distributed to members inviting them to be present.
3. That the teachers of the public schools be invited to bring their classes to the Academy when practicable — notifying the Curator a day or two in advance — and that some member explain to the children some class of specimens in the museum; and that the teachers throughout the county be included in this arrangement.
4. That a systematic and persistent effort be made by canvassing the city, members, and non-members, to secure lectures and scientific papers for our meetings, so as to have a reliable list prepared.
5. That all members be urged to endeavor to interest their friends and bring in new members; and also to attend and induce their friends to attend the meetings.

Report was received and committee discharged.

February 24, 1888.— Regular Meeting.

President C. E. Harrison in the chair.

A communication was read from the Peoria Scientific Association, sending greetings and newspaper notices of their Annual Meeting; also, from Jefferson County Library Association, sending an account of their annual meeting. The Secretary was instructed to exchange friendly greeting with both these societies.

The subject of "Meteors" was then discussed, and the specimens in the Academy museum displayed and their history given by the Curator.

The President announced the death of two honorary members of the Academy, Dr. Asa Gray, who died January 30, and Prof. George W. Tryon, February 5, 1888.

Adjourned to reorganize the Historical Section.

March 2, 1888.—ADJOURNED MEETING.

President C. E. Harrison in the chair; eleven members and a number of visitors present.

Librarian reported one hundred twenty-six additions to the library.

Curator reported valuable donation to the museum of a collection of marine specimens from Prof. B. Shimek, of Iowa City; alcoholic, twenty-eight species; dry, twenty-three species.

Mrs. Lucy E. Harrison was duly elected a regular member of the Academy.

The Historical Section was reported to be not yet regularly organized, but committees have been appointed to take the necessary steps. The Section desires the coöperation of the Academy in arranging to celebrate, with other historical societies, the anniversary of Marquette's discovery of the Mississippi River. The committee reported progress in the preparation of a programme.

The subject for discussion, "Volapuk," was then taken up. No paper was presented, but an informal discussion was participated in by most of those present. It was voted to continue the subject to a subsequent meeting.

March 30, 1888.—REGULAR MEETING.

President C. E. Harrison in the chair; eight members present.

Librarian reported two hundred twenty-three additions to the library.

The Treasurer reported the collection by Mrs. Putnam:

Annual Subscriptions	$402 00
Annual Dues	70 00
	$472 00
Paid to Treasurer	$ 60 00
" " Curator	148 00
" Coal Bills	36 00
" Egbert & Co	50 00
" Note in Bank	100 00
	$394 00
Collected on Publication Fund	$ 36 00

Mr. Frank Nadler was elected a regular member of the Academy.

On motion, it was voted to announce the Academy open every Friday evening. The attendance of members is requested and friends are invited.

Adjourned to Historical Section.

May 25, 1888.—Regular Meeting.

President C. E. Harrison in the chair; eleven members present.

Committee on the Marquette Celebration reported progress.

Librarian reported three hundred twenty-seven additions to the library.

A communication received from General Greeley, of the United States Signal Service, was read, offering to coöperate in gathering thunder-storm data. He will furnish blanks and franked envelopes. Two hundred fifty circulars have been sent out this year, and eighty observers are already enrolled. Great encouragement is felt at the interest of General Greeley in our efforts.

The most notable donations during the month have been a box of fossils from Judge Wakefield, Sioux City, and a large section of a tusk of the mastodon, six and one-half inches in diameter, weighing thirty pounds, which Mr. Chris. Benedix brought from California for the Academy. A vote of thanks was tendered to Mr. Benedix. The mastodon and the mammoth were compared and discussed.

A paper by Prof. C. L. Berthoud, Golden, Colorado, on "The Occurrence of Buddhistic Emblems in the collections of the National Museum," was read and referred to Publication Committee.

June 29, 1888.—Regular Meeting.

President C. E. Harrison in the chair; five members present.

Mr. Fulton, from the committee on the Marquette Celebration, reported a public meeting of great interest, with a varied programme, Mr. DeArmond giving the Historical address. On motion of Mr. Fulton, a vote of thanks was tendered Mrs. Forrest, who sang, and Miss Nichols, who accompanied her on the piano, for adding so greatly to the pleasure of the entertainment.

William F. Greenlee, Belle Plaine, Iowa, was elected to corresponding membership.

The President announced the death of two corresponding members: Prof. A. H. Worthen died May 6, and Prof. W. D. Gunning died March 8; also, Mr. J. J. Dahms, a regular member, who died April 16.

The subject, "A New way of Finding the Foci of an Ellipse," was then discussed, illustrated by original and ingenious drawings and apparatus.

June 8, 1888.—SPECIAL MEETING.

President C. E. Harrison in the chair; fifteen members present.

The President stated the object of the meeting to be, to meet Mr. W. J. McGee, of the United States Geological Survey at Washington, D. C.

After some informal talk, Prof. McGee was invited to address the meeting, and in compliance with the request he gave a very interesting address, discussing at some length the status and needs of our Academy, and the condition of scientific institutions generally in the West.

The Academy then adjourned, and some further time was spent in informal conversation.

July 9, 1888.—ADJOURNED TRUSTEES' MEETING.

President C. E. Harrison in the chair; eight members present.

President stated that the principal subject for consideration for this meeting was the financial condition of the Academy and the means to be adopted for provision of funds to meet expenses.

After considerable discussion regarding entertainments, lectures, etc., Dr. Preston moved the appointment of a committee consisting of Messrs. Fulton, Pratt, and Hazen, to ascertain the feasibility of the above matters, and to report at an adjourned meeting.

July 19, 1888.—ADJOURNED TRUSTEES' MEETING.

President C. E. Harrison in the chair; nine members present.

Report of the special committee read, and, on motion, amended and adopted, as follows:

TO THE TRUSTEES OF THE DAVENPORT ACADEMY OF NATURAL SCIENCES:

Your special committee, appointed July 9, 1888, would respectfully report and recommend—

1. That an admission fee to the Academy building, of ten cents, be charged, members and children under ten years of age being admitted free.

2. That a course of ten home lectures be given in the Academy during October, November, December, January and February next, and that there be charged an admission fee of fifteen cents, or one dollar for a ticket admitting to the entire course.

3. That an effort be made to increase the usefulness of the Academy, and to that end, that special studies of the different departments be provided for at stated times.

4. That an entertainment be given on the twenty-first anniversary of the Academy's birth, December 14th.

Respectfully submitted, H. C. FULTON,
W. H. PRATT,
E. H. HAZEN.

On motion, the President appointed H. C. Fulton, Dr. McCowen, and W. H. Pratt a committee to carry out the above Home Lecture Course, and such other lectures as may be secured.

On motion of Mr. Fulton, a committee consisting of Drs. Preston and Hazen, and William Riepe, with the Curator as chairman, was appointed to carry out the plan of the third recommendation.

The President stated that parties from Le Claire were desirous of obtaining two lots in that city owned by the Academy. After discussion, Messrs. Harrison and Fulton were appointed a committee with power to act in the matter.

August 31, 1888.—Regular Meeting.

President C. E. Harrison in the chair; six members present.

Librarian reported three hundred eighty-seven additions to the library.

Curator reported numerous and valuable additions to the museum.

Dr. P. R. Hoy, of Racine, Wisconsin, was elected as corresponding member.

Committee on ways and means reported the recommendations which had been adopted by the Board of Trustees.

Specimens of zinc ore from the Cook quarry, also clay, fossils, and shells collected by Prof. Pratt, were exhibited. Some discussion ensued on the nature of the recent finds in that locality, and the small probability of their value from a commercial point of view.

The Curator called attention to some of the untenable theories upon which the De Bausset air-ship is planned, for the construction of which Congress is asked to make an appropriation of $75,000 and authorize the use of one of the government navy-yards for the building of the machine. An extended discussion followed, participated in by most of those present.

September 24, 1888.—Trustees' Meeting.

President C. E. Harrison in the chair; nine members present.

Special meeting of the Trustees convened at Dr. Preston's office to take action on a communication received from Charles R. Keyes, of Burlington, in regard to the publication of his paper on "The Birds of Iowa."

On motion of Mr. Fulton, it was voted "That it is the sense of the Trustees, that the paper by Mr. Keyes, on 'The Birds of Iowa,' be published as soon as possible."

Dr. Hazen presented to the Trustees a Spectacular Drama which he had prepared, as suitable, perhaps, for the anniversary meeting.

The President reported that the property of the Academy in Le Claire had been sold for $25.00.

On motion of Mr. Pratt, it was voted to place the amount to the credit of the Publication Fund.

Mr. Fulton, on behalf of the Lecture Committee, reported encouraging progress in securing local speakers and arranging topics and dates.

On motion of Mr. Pratt, it was voted to give complimentary tickets to the course to the members of the Agassiz Chapters of the city.

September 28, 1888.—Regular Meeting.

President C. E. Harrison in the chair; nine members present.

Additions to the library, one hundred twenty-seven. Library Committee reported four hundred feet of additional shelving put up during the month, making room for four thousand more books and pamphlets.

The Museum Committee reported that they had secured the promise of the necessary four cases to complete the alcove arrangement of the basement, which would provide a very desirable and necessary addition to the available space for displaying the collection.

The feasibility of cutting and polishing specimens in the Academy was discussed and laid over for further information as to necessary fixtures, expenses, etc.

October 13, 1888.— Special Meeting.

Special meeting convened at the office of Dr. Preston to take action in relation to the decease of the Hon. George H. French, one of our life members.

President C. E. Harrison in the chair; eleven members present.

The President stated the object for which the meeting was called, and in pursuance of this object, he appointed a committee on resolutions consisting of James Thompson, Dr. C. H. Preston, and Major G. P McClelland.

On behalf of the committee, Mr. Thompson presented the following resolutions, which were unanimously adopted:

Whereas, Amid the changes of human life, our esteemed and respected fellow-citizen, the Hon. George H. French, has closed his earthly career and left the scenes of his usefulness here in the full strength of his manhood forever; and

PLATE I.

FIGS. 1–3.—*Valvata utahensis.*

4–6.—*Amnicola dalli.*

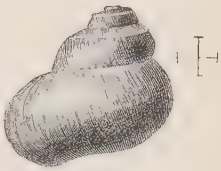
7–9.—*Radix utahensis.*

10–13.—*Limnophysa bonnevillensis.*

PLATE I.

1

2



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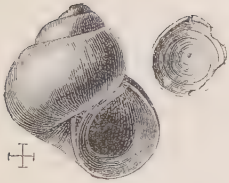

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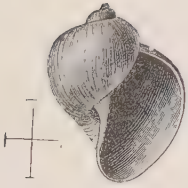

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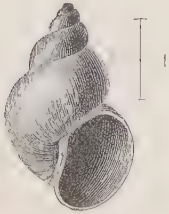


12

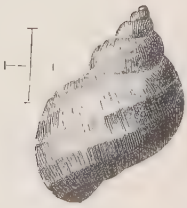


PLATE II.

All original figures except 14 *b*, 14 *c*, and 17 *a* are enlarged three diameters.

FIGS. 1–6 — *P. nevadensis*, carinate forms.

7–8 — " smooth var.

9 — " operculum.

10 — " Copy of Stearns' figure in Proc. Phila. Ac. Nat. Sci., p. 173 (1883).

11–12 — *Pyrgula helvetica*, Mich.

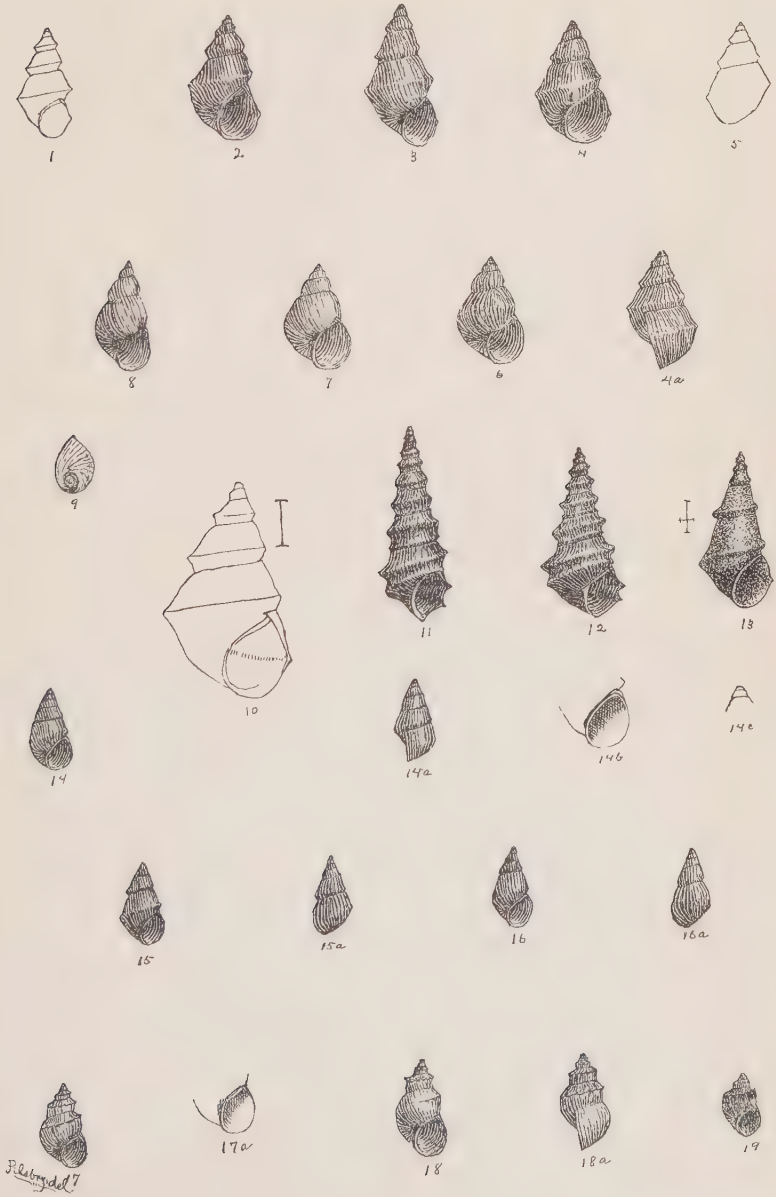
13 — *P. scalariformis* — Copy of Wolf's figure in Am. Jour. Conch., Vol. V., pl. xvii., fig. 3.

14–16 — *P. mississippiensis.*

17–19 — *P. spinosus.*

All figures except 10 and 13 are drawn from specimens in the authors' cabinets.

PLATE II.



CALL AND PILSBRY ON PYRGULOPSIS.

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